UNIVERSITY OF GHANA

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COLLEGE OF HEALTH SCIENCES

ISONIAZIDE PREVENTIVE THERAPY UPTAKE AMONGST CHILD CONTACTS OF ADULTS DIAGNOSED WITH SMEAR POSITIVE PULMONARY TUBERCULOSIS IN SELECTED HEALTH FACILITIES IN DOUALA, CAMEROON

BY

AYEAH MARK CHIA

ID NO. 10746817

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DECLARATION

I, Mark Chia AYEAH, declare that except for the other people's investigations which have been duly acknowledged, this work is the result of my own original research, and that this dissertation, either in whole or in part has not been presented elsewhere for another degree.

Signature: Date:

AYEAH MARK CHIA

(MPH STUDENT)

Signature: Date:

DR. FRANCIS ANTO

(ACADEMIC SUPERVISOR)

DEDICATION

This piece of work is dedicated to my awesome family whose support has been impeccable and invaluable up to this point in life. May the Almighty God richly bless you all.

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Above all, I am so immensely grateful to God Almighty for the gift of life, wisdom, good health, family and other immeasurable blessings throughout my medical studies. To God be all the glory forever and ever.

ABSTRACT

Background: Childhood tuberculosis (TB) remains a major public health problem worldwide, especially in developing countries. Despite clear evidence that isoniazid preventive therapy (IPT) can reduce the risk of progression from TB infection to disease in TB contacts, uptake of IPT in children is low and IPT delivery is a challenge in many resource-limited settings with high TB-burden. Furthermore, the IPT initiation rates amongst child TB program implementation settings in Cameroon has not been reported and may be sub-optimal. Therefore this study was carried out to determine the level of IPT uptake and its associated factors amongst child contacts of adults diagnosed with smear-positive pulmonary tuberculosis (SPPTB).

Methods: This was a mixed-method study involving quantitative and qualitative components. The quantitative component was conducted among child contacts of adult patients diagnosed with SPPTB (index case). Background, clinical, health facility, community and IPT related data were collected from 9 selected health facilities using interviewer administered questionnaires. Descriptive statistics was used to generate frequency tables and figures. Logistic regression analysis was performed to determine factors independently associated with IPT uptake. This was followed by qualitative phase which employed in-depth interviews (IDIs) with healthcare workers. The IDI sessions was taped, transcribed verbatim and analysed using a thematic approach.

Results: A total of 513 child contacts were included amongst which 118 (23.0%; 95% CI: 19.6-26.9) had received IPT. Index cases aged 21-30 years [OR=34.712; (95% CI: 4.801-250.998); p<0.001] and 31-40 years [OR=10.094; (95% CI: 1.472-69.200); p=0.019], being the parents of the child contact [OR=2.142 ; (95% CI: 1.070-4.286); p=0.031] and sharing the same room with child [OR=3.939; (95% CI: 1.399-11.092); p=0.009] were associated with IPT uptake. Furthermore, child contact tracing [OR=5.783; (95% CI: 1.458-22.938); p=0.013], child

contact screening [OR=39.308; (95% CI: 9.395-135.973); p<0.001], being educated on the benefits of ITP during anti-TB treatment [OR=3.865; (95% CI: 1.172-12.746); p=0.026], experiencing TB related stigma [OR=10.624; (95% CI: 3.188-35.410); p<0.001] and attending an accessible health facility [OR=4.021; (95% CI: 1.297-12.467); p=0.016] were also associated with IPT uptake. The level of knowledge on the benefits of IPT, continuous emphasis, education and sensitization on the need for IPT, good index case/health worker relationship, contact tracing and reduced cost of screening were seen to facilitate the uptake of IPT.

Conclusion: This study showed that the implementation of IPT was 23%. Few child contacts of index cases are screened for active TB and even fewer are offered IPT. IPT uptake may be scaled up by simplifying screening procedures, providing free screening services, intensifying contact tracing, educating index cases at each hospital visit, maintaining good index case/health worker relationships, providing of health workers, improving logistics and enhancing supervision and monitoring.

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LIST OF ABBREVIATION

ABBREVIATION	FULL MEANING
BCG	Bacille Calmette-Guerin
CI	Confidence interval
CCM	Child case management
CXR	Chest x-ray
DOT	Directly observed therapy
HIV	Human immunodeficiency virus
IDIs	In-depth interviews
INH	Isoniazid
IPT	Isoniazid preventive therapy
MDR-TB	Multidrug resistant TB
MUAC	Mid upper arm circumference
Mtb	*Mycobacterium tuberculosis*
NTP	National TB program
PI	Principal investigator
PTB	Pulmonary tuberculosis
SPPTB	Smear positive pulmonary tuberculosis
TB	Tuberculosis
TST	Tuberculin skin test
WHO	World health organization

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Tuberculosis (TB) is preventable and curable chronic infectious disease caused by *Mycobacterium tuberculosis (Mtb)*. It usually affects the lungs causing pulmonary TB but can also affect other parts of the body causing extrapulmonary TB (Gebremichael, Abebaw, Moges, Abaerei, & Worede, 2018). TB is one of the leading causes of mortality and morbidity across all age groups throughout the world, especially in developing countries (Centers for Disease Control and Prevention (CDC), 1993). Globally, TB is one of the top 10 causes of death worldwide and in 2017 about 10.0 million people (9.0–11.1 million) developed TB disease and 1.6 million died from the disease (WHO, 2018a). In 2017, an estimated 1 million children became ill with TB and the annual burden of childhood mortality was 230 000, including children with human immune deficiency virus (HIV) associated TB(WHO, 2018a). Childhood TB has a higher risk of severe disease and death among young children than adults (Nelson & Wells, 2004; Raviglione, Snider, & Kochi, 1995). In Cameroon the estimated TB incidence rate was 203 per 100,000 persons per year and an estimated 6200 children aged 0-14 years had TB in 2017 (WHO, 2017a). TB case notification rates in Cameroon between 2006 and 2014 showed a slow but steady decrease, but there is evidence to suggest that TB transmission is still ongoing(Noeske, Nana Yakam, & Abena Foe, 2016).

The actual burden of childhood TB is likely to be higher, because diagnosing TB in children is challenging in low-resource settings (Tsai et al., 2013; WHO, 2015a). Even though the proportion of TB in children is smaller, the burden of childhood TB cannot be underestimated because it remains a low priority in low-resource settings and children are at high risk of

developing TB due to their developing immature immune system (Ahmed et al., 2008; Newton, Brent, Anderson, Whittaker, & Kampmann, 2008).

Children who have not received the Bacille Calmette-Guérin (BCG) vaccine are at risk of developing TB and the HIV status, age of the child and family practice of feeding children raw milk are the independent predictors of childhood TB (Gebremichael et al., 2018). Data from several studies globally described shows that factors directly and indirectly related to poverty like malnutrition, some demographic characteristics, living standards and style are independent predictors of childhood TB (Jurcev-Savicevic et al., 2013; M. R. Karim, Rahman, Mamun, Alam, & Akhter, 2012; Kirenga et al., 2015; Tesema, Tadesse, Gebrehiwot, Tsegaw, & Weldegebreal, 2015).

To mitigate the substantial burden of childhood TB, the World Health Organisation (WHO) recommends routine screening of child contacts under 5 years in all settings of high TB incidence through a symptom-based screening approach and the provision of isoniazid preventive therapy (IPT) for child contacts at risk of developing active disease (WHO, 2015b). IPT is therefore a form of chemoprophylaxis that is offered to those at risk of acquiring TB after active TB disease is ruled out through screening. In practice, children under five years presenting with symptoms suggestive of TB after a history of exposure to an adult patient diagnosed with SPPTB might already have active TB disease and are therefore not put on IPT but rather undergo appropriate investigations for active TB disease. If these investigations turn out to be negative for presumptive TB, they are placed on a six months course of IPT as well as their counterparts that were screened symptomatically but responded negatively to all screening questions.

According to WHO global reports in 2017, a total of 292,182 children had access to TB preventive therapy and only 23% of the estimated 1.3 million children under 5 years of age eligible for preventive therapy in TB households received this in 2017 (WHO, 2018a). The

END TB Strategy of WHO is aimed at reducing the global TB incidence and mortality by 90% and 95% respectively by the year 2035 (WHO, 2016). This crucial target calls for immediate attention at global and local context. Active TB case detection, child contact screening, child contact management (CCM) and TB preventive therapy amongst child contacts of adult patients with smear positive pulmonary tuberculosis (SPPTB) are crucial factors to consider in order to reduce the burden of childhood TB. The national TB prevention (NTP) program in Cameroon started the implementation of IPT amongst child contacts under the age 5 about 3 years ago. Therefore, the purpose of this study was to determine the level of IPT uptake and its associated factors amongst child contacts of adults diagnosed with SPPTB in Douala.

1.2 Problem statement

The NTP program in Cameroon recommends the regular screening of child contacts of TB patients and the provision of IPT as one intervention to prevent childhood TB. WHO recommends that the target for IPT coverage should be ≥ 90% (WHO, 2017b). In Cameroon, only 0.86% (0.79-0.95) of 10300 (9400-11200) child contacts of smear positive TB index cases are on preventive treatment (WHO, 2018a). Consequently, the burden of childhood TB remains high in Cameroon. The level of awareness among health care providers, interruption of isoniazid (INH) supply, co-infection with the human immunodeficiency virus (HIV), lack of recording tools for IPT and distance from health facilities affect uptake of the service in different settings (Tadesse et al., 2016). Such low coverage is likely to hinder achieving the WHO target of reducing TB incidence and mortality by 90% and 95% respectively by the year 2035 (WHO, 2016).

Despite the growing epidemiological evidence of the potential benefits of contact screening for active case detection and initiation of IPT, these interventions are rarely implemented in regions of high TB incidence (Hill, Rutherford, Audas, van Crevel, & Graham, 2011; Rutherford et al., 2012). Furthermore, the uptake of IPT offered to eligible child contacts is

quite poor and remains a challenge (Garie KT, Yassin MA, & Cuevas LE, 2011; Jafri et al., 2015; Nyirenda, Sinfield, Haves, Molyneux, & Graham, 2006). Furthermore, the IPT initiation and completion rates amongst child TB program implementation settings in Cameroon has not been reported and may be sub-optimal. This study assessed the outcome of the implementation of IPT in real life settings in selected facilities in Douala, Cameroon.

1.3 Justification

This study was relevant due to the low IPT coverage in Cameroon which indicates that several barriers to the implementation of IPT exist. If no interventions to scale up IPT uptake is done, the burden of childhood TB will continue to increase. Therefore, in order to improve on IPT coverage and reduce the burden of childhood TB in Cameroon, it is important that the bottlenecks to IPT uptake among eligible child contacts are identified and solved. Investigating active TB case findings and IPT uptake is also very crucial since it is a major contributing factor to attaining both national and global goals of improved TB control and possible eradication of TB epidemic. The findings of the study will:

1. Provide a situational analysis regarding the implementation of IPT in Cameroon
2. Assess the level of IPT coverage amongst child contacts of adult TB patients. The NTP will utilize the findings of the study to scale up IPT uptake amongst child contacts hence reducing the burden of childhood TB
3. Serve as an additional knowledge on the implementation barriers affecting IPT uptake, as an efficacious tool for TB control. With this, solutions can be adopted to strengthen its efficacy.
4. Create awareness amongst among TB health workers in Cameroon on the need to improve child contact management.

1.4 Conceptual framework

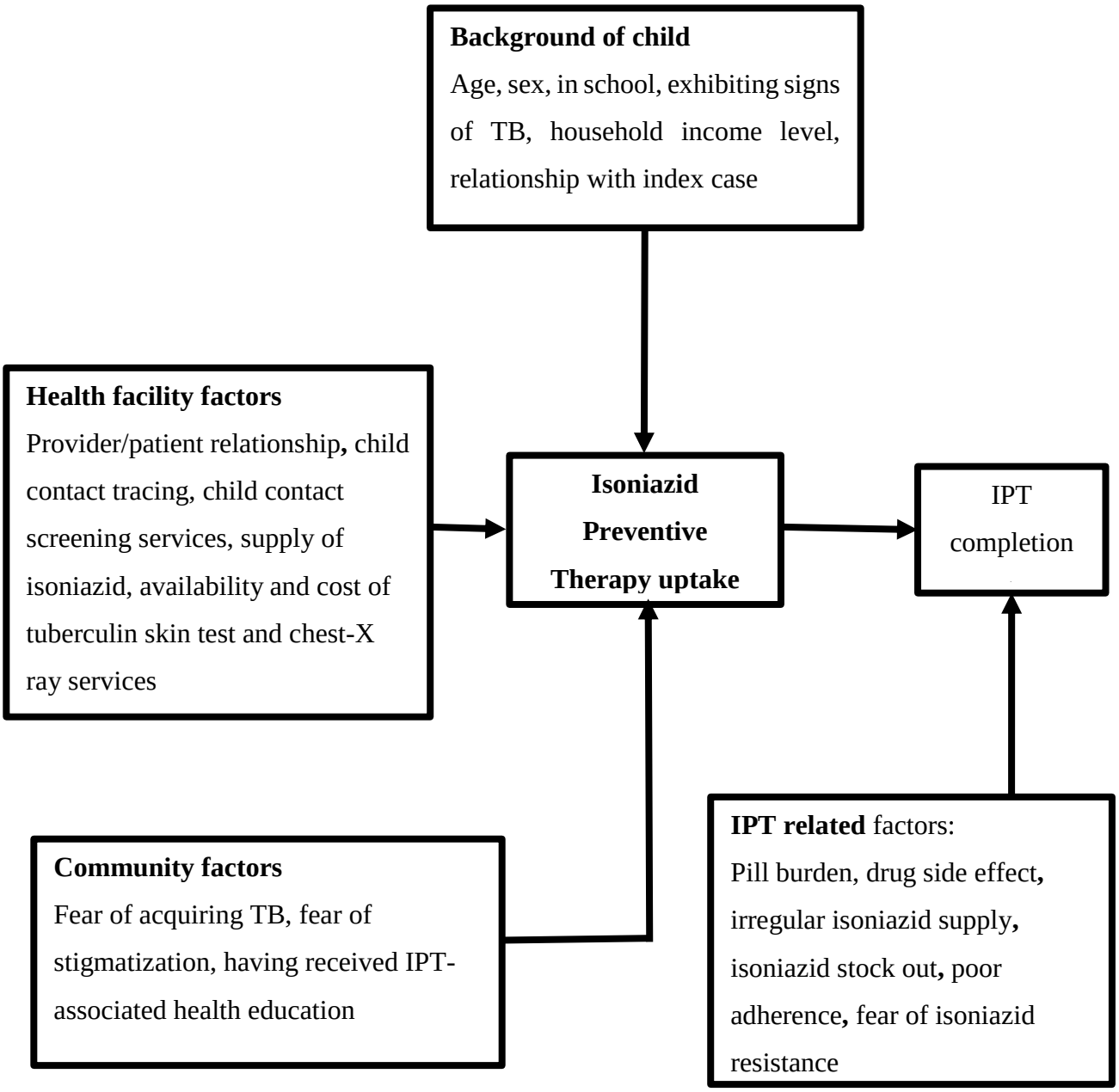

Figure 1: Conceptual framework of factors likely to influence IPT uptake in selected health facilities in Douala.

1.4.1 Narrative of conceptual framework

The factors likely to influence IPT uptake amongst children can be grouped into 3 main groups:

1.4.1.1 Family background of the child

Factors related to the background of the include age, gender, marital status, area of residence, level of education, employment status, monthly income and socioeconomic status of TB case. Child contacts of TB cases who are household heads, married, less educated, unemployed and of low socioeconomic status will have a higher risk of having being infected with TB hence the need for more IPT coverage and completion. Clinical profile of TB index case: Smear positive status, HIV positive status, current TB or previous TB treatment, knowledge of IPT and previous use of IPT are more likely to increase IPT uptake and completion amongst child contacts. This is because smear positive patients who are HIV positive and currently receiving treatment may turn to have more knowledge of TB and its preventive methods during their refill visits. Furthermore patients with prior knowledge of IPT and those who may have previously used IPT are more likely accept the provision of IPT for their children at risk. At the time of TB diagnosis, child contacts with crowded household density, longer average time spent per day with contact and sleeping in the same room may increase the need for TB screening and TB screening also in turn prompts the IPT uptake. Younger child contacts < 12 months, females, being a child of adult TB index case, having TB related symptoms and the absence of Bacille Calmette-Guérin vaccination (BCG) scar will definitely prompt the need for child contact tracing, screening and IPT uptake.

1.4.1.2 Health facility factors

They include; provider/patient relationship, cost of transportation by the child contact and adult TB index case for screening test and collection of isoniazid (INH), child contact tracing, child

contact screening services, cost of screening test like tuberculin skin test, supply of isoniazid and the availability of tuberculin skin test, chest-X ray (CXR) machine and gene X-pert machines. These factors can individually or collectively affect IPT uptake. For example, if INH stock is always up-to-date, then more eligible child contacts will be placed on IPT. Furthermore, the availability of necessary child contact screening services, reduced or subsidized cost of screening and transportation to and from the health facility can increase IPT uptake. The absence of these health facility components can influence IPT uptake and completion as it leads to fewer child contacts being enrolled for IPT uptake.

1.4.1.3 Community factors

Fear of acquiring TB, fear of stigmatization, lack of money for transport, having received IPT-associated health education and a reluctance to take medication in the absence of symptoms by members of the community can likely influence the uptake of IPT.

1.4.1.4 IPT related factors

They include; pill burden, drug side effect, irregular isoniazid supply, isoniazid stock out, poor adherence and fear of isoniazid resistance can individually or collectively influence adherence and completion. These factors could also act as barriers to the implementation of IPT by the healthcare provider and affect the acceptance of IPT by the TB cases for use by their children who are at risk. Hence many TB index cases will refuse to enrol their child contacts for screening and subsequent IPT use.

A low IPT coverage and factors associated with decreased IPT uptake increases the incidence of childhood TB, hence the mortality and morbidity associated with TB amongst children remains high.

1.5 Research questions

1. In a population of child contacts of smear positive TB cases eligible for isoniazid preventive therapy, what proportion received isoniazid preventive therapy?
2. In a population of child contacts of smear positive TB cases, what are the factors associated with uptake of isoniazid preventive therapy?
3. In a population of T child contacts of smear positive TB cases, what are the facilitators of isoniazid preventive therapy uptake?

1.6 Objectives

1.6.1 General objective

To determine the level of isoniazid preventive therapy uptake and associated factors amongst child contacts of smear positive TB cases in selected health facilities in Douala, Cameroon.

1.6.2 Specific objectives

1. To determine the proportion of child contacts of smear positive TB cases who are on isoniazid preventive therapy
2. To identify factors associated with uptake of isoniazid preventive therapy amongst child contacts of smear positive TB cases.
3. To identify the facilitators of isoniazid preventive therapy uptake amongst child contacts of smear positive TB cases.

CHAPTER TWO

LITERATURE REVIEW

2.1 Epidemiology of Tuberculosis

The estimated global burden of TB in 2017 is 10 million incident cases and TB is a leading killer of HIV-positive people (WHO, 2018a). Multidrug-resistant TB (MDR-TB) remains a public health crisis and WHO estimates that there were 558 000 new cases with resistance to rifampicin – the most effective first-line drug, of which - 82% had MDR-TB (WHO, 2018a). Even though the global incidence of TB is falling at about 2% per year, there is need to accelerate to a 4-5% annual decline to reach the 2020 milestones of the End TB Strategy (WHO, 2018a). An estimated 54 million lives were saved through TB diagnosis and treatment between 2000 and 2017 and ending the TB epidemic by 2030 is among the health targets of the Sustainable Development Goals (WHO, 2018a).

TB occurs in every part of the world and pose the greatest threat to the human lives in Africa due to limited and overwhelming health care services. In 2017, the largest number of new TB cases occurred in the South-East Asia and Western Pacific regions representing 62% of new cases, followed by the African region, with 25% of new cases (WHO, 2018d). In 2017, 87% of new TB cases occurred in the 30 high TB burden countries and eight countries accounted for two thirds of the new TB cases: India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh and South Africa (WHO, 2018d). In high TB burden countries, children are said to account for 15-20% of all TB cases, compared with 2-7% in low-burden countries (Daniel, Adejumo, Gidado, Abdur-Razzaq, & Jaiyesimi, 2015).

In Cameroon the estimated TB incidence rate was 203 per 100,000 persons per year and an estimated 6200 children aged 0-14 years had TB in 2017 (WHO, 2017a). Like other countries, the burden of TB in Cameroon is unevenly distributed. The male sex is associated with higher incidence of the disease and in 2017, a total of 24905 cases was notified with a 52% treatment

coverage (WHO, 2017a). Figure 2 shows the estimated global TB incidence rates reported by WHO in 2017.

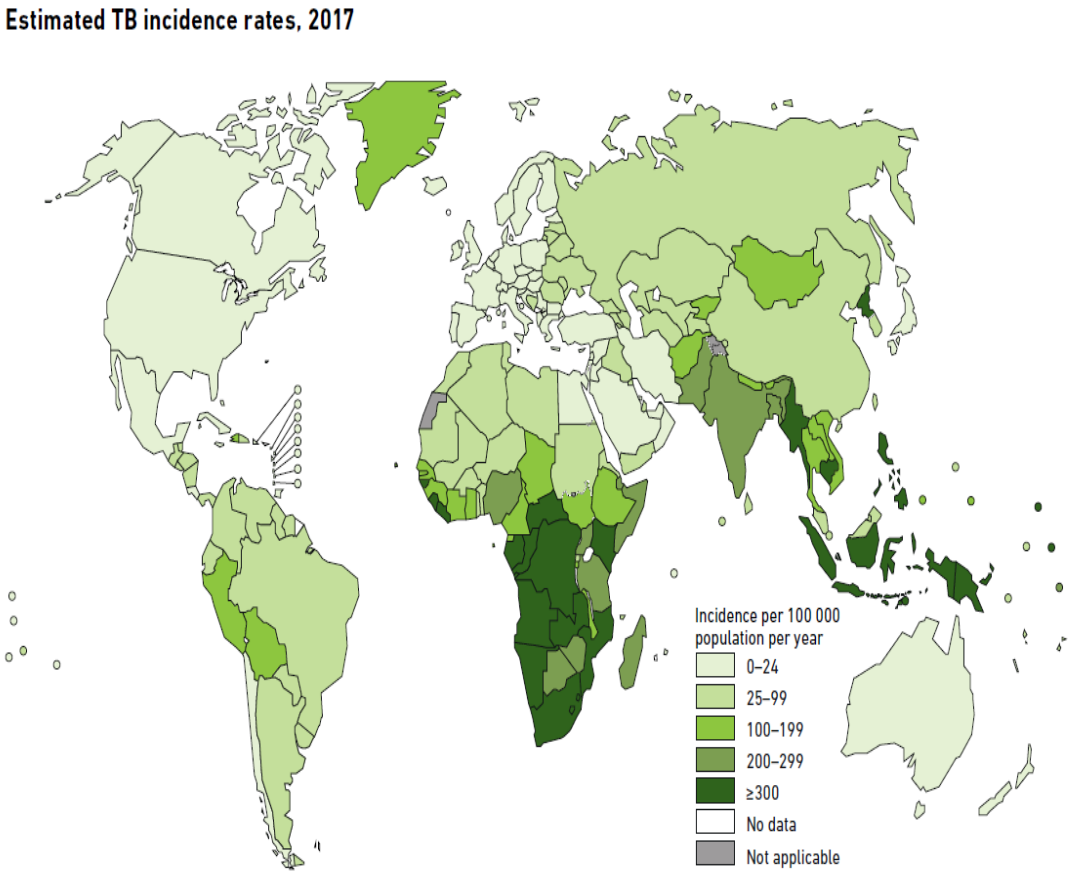

Figure 2: Estimated 2017 global TB incidence rates (source: Global TB reports 2018)

2.2 Aetiology and Risk Factors of TB

TB is almost exclusively transmitted through the inhalation of air droplets containing the bacilli from *Mycobacterium tuberculosis (Mtb)* from patients with active PTB (Raviglione et al., 1995). The risk of transmission is greatest if the index case is "sputum smear positive", and is directly proportional to the bacillary density in respiratory secretions (Van Zwanenberg, 1960). The risk factors of TB is similar in both children and adults but children can easily develop active TB when exposed to adults patients diagnosed with SPPTB. Children from 1–2 years have a 20%–30% risk, those from 3–5 years a risk of 5%, those 5–10 years old only a 2% risk and older children an adult-like risk (5%) (Comstock, Livesay, & Woolpert, 1974; Marais, Gie, Schaaf, Hesseling, Obihara, Nelson, et al., 2004; Marais, Gie, Schaaf, Hesseling, Obihara, Starke, et al., 2004). Young children are also more likely to develop the most severe forms of TB, such as TB meningitis or military TB (Seddon & Shingadia, 2014).

HIV is a key factor behind the resurgence in TB incidence worldwide and remains the pre-eminent risk factor for the development of TB (Venturini et al., 2014). The risk of progression from latent TB to active TB is significantly higher among HIV-infected population (LIU et al., 2015). Infants (children <12 months) with HIV are twenty times as likely to develop TB as children without HIV (Hesseling et al., 2009). In 2013, globally people living with HIV are 29 times more likely to develop active TB disease than those who are HIV-negative (World Health Organization, 2014). Risk factors for incident TB amongst HIV patients include being male, having low body mass index or middle upper arm circumference, lower CD4 cell count, and advanced WHO disease stage (LIU et al., 2015). In Tanzania, male gender, WHO clinical stage 3 and 4, baseline CD4 count <200 cells/µl and having not used IPT were independently associated with the active TB amongst people with HIV and on antiretroviral therapy (Gunda et al., 2018). A case control study from rural Bangladesh showed that children under 14 years of age, having completed primary education, whose fathers' were in business or service, who

slept in a less crowded room and lived in a house with a separate kitchen had less chance of having TB (M. R. Karim et al., 2012). A cross sectional study among children aged 18 months to 15 years in six selected health facilities in Nasarawa State of Nigerian revealed that lower socioeconomic status, history of contact with an adult TB case source, overcrowding, absence of cross ventilation, ingestion of unpasteurized milk and severe malnutrition among children under five using mid upper arm circumference (MUAC) parameter were risk factors associated with PTB (Attah et al., 2018). In India, the risk factors associated with TB amongst children under the age of 5 were; younger age, severe malnutrition, absence of BCG vaccination, contact with an adult who was sputum positive, and exposure to environmental tobacco smoke (Singh et al., 2005). In the Demographic Republic of Congo, the TB related mortality amongst children is 23.3% and age ≤ 5 years, emaciation, HIV positive status, smear negativity by direct microscopy and leukocytes ≥12000/mm3 are independent predictors of mortality(Dn et al., 2017). In Africa where TB is endemic, very few studies have been conducted on the risk factors of childhood TB.

2.3 Diagnosis and Treatment of TB

Early detection and diagnosis of TB is essential to the control of the disease (Andersen, Munk, Pollock, & Doherty, 2000). There are different ways for TB diagnosis. Diagnosing PTB in children begins with a complete clinical assessment for suggestive signs and symptoms such as cough, fever, loss of appetite, weight loss and night sweats, followed by the collection of specimen for microbiologic testing. Other available routine investigations such as chest radiography (anteroposterior and lateral views), a tuberculin skin test (TST) and HIV testing can be done. Several methods are used to collect these specimens such as induced sputum specimens, nasopharyngeal aspirates, gastric lavage, tracheal aspirate or bronchoalveolar lavage. After these specimens are obtained, acid-fast staining, culture and rapid diagnostic testing with Xpert MTB/RIF assay can be done to confirm the diagnosis of active PTB.

Children with TB can be classified into 1 of 5 diagnostic categories according to the National Institute of Health (NIH) criteria as follows (Graham et al., 2012): confirmed TB (at least 1 sign or symptom and 1 positive culture); probable TB (at least 1 sign or symptom and a chest radiograph consistent with tuberculosis and 1 of the following; clinical response to TB treatment, documented exposure to *Mtb* or immunologic evidence of infection with *Mtb*); possible TB (at least 1 sign or symptom and 1 of the following; chest radiograph consistent with tuberculosis clinical response to TB treatment, documented exposure to *Mtb* or immunologic evidence of infection with *Mtb*); TB unlikely (symptomatic but no other criteria); and not TB (symptomatic but no other criteria and an alternative diagnosis established).

The diagnosis of childhood TB is complicated by the absence of a practical gold standard (Eamranond & Jaramillo, 2001; J. R. Starke, 1993). The diagnosis of PTB in children is often challenging due to nonspecific symptoms, signs and radiological changes and this makes it difficult to easily make a definitive microbiologic diagnosis (Zar, Connell, & Nicol, 2010). Sputum microscopy, often the only diagnostic test available in endemic areas, is positive in only <10–15% of children with probable PTB (Starke, 2003; Zar et al., 2005). However, advances in specimen collection and diagnostic tests have improved the ability to make a microbiologic diagnosis in children (Bates et al., 2013; Nicol et al., 2011; Rachow et al., 2012; Sekadde et al., 2013; Zar et al., 2012). Since a confirmed microbiologic diagnosis can only be achieved among few children with suspected PTB, a clinical diagnosis remains the predominant method for determining whether a child has TB and initiating treatment (Zar, Workman, Little, & Nicol, 2015). It is worth noting that 6.7 million people with TB were notified to NTPs globally and reported to WHO (WHO, 2018a).

The most effective strategy to ensure adherence to TB treatment is by directly observed therapy (DOT). DOT is a specific strategy, endorsed by WHO, to improve adherence by requiring health workers, community volunteers or family members to observe and record patients taking

each dose (Karumbi & Garner, 2015). WHO recommends that people with active TB are treated with a standard 6 month course of 4 antimicrobial drugs namely isoniazid, rifampicin, ethambutol and pyrazinamide. Failure to complete treatment can lead to relapse and even death in individuals, and also has important public health consequences, such as increased TB transmission and the development of drug resistance(Karumbi & Garner, 2015).

2.4 TB Prevention

In 2015, WHO adopted the End TB Strategy with the overall goal to "End the global TB epidemic", and there were three high-level, overarching indicators and related targets for 2030 and 2035 (WHO, 2018b). These three indicators were: the number of TB deaths per year; the TB incidence rate (new cases per 100 000 population per year); and the percentage of TB-affected households that experience catastrophic costs as a result of TB disease (WHO, 2018b). The 2030 targets are a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate, compared with levels in 2015 while the 2035 targets are a 95% reduction in TB deaths and a 90% reduction in the TB incidence rate, compared with levels in 2015 (WHO, 2018b). Essentially, the prevention of new infections of *Mtb* and their progression to TB disease is critical to reduce the burden of disease and death caused by TB, and to achieve the End TB Strategy targets set for 2030 and 2035(WHO, 2016). Currently, three major categories of health interventions are available for TB prevention: treatment of latent tuberculosis infection (LTBI); prevention of transmission of *Mtb* through infection prevention and control; and vaccination of children with the BCG vaccine (WHO, 2018b).

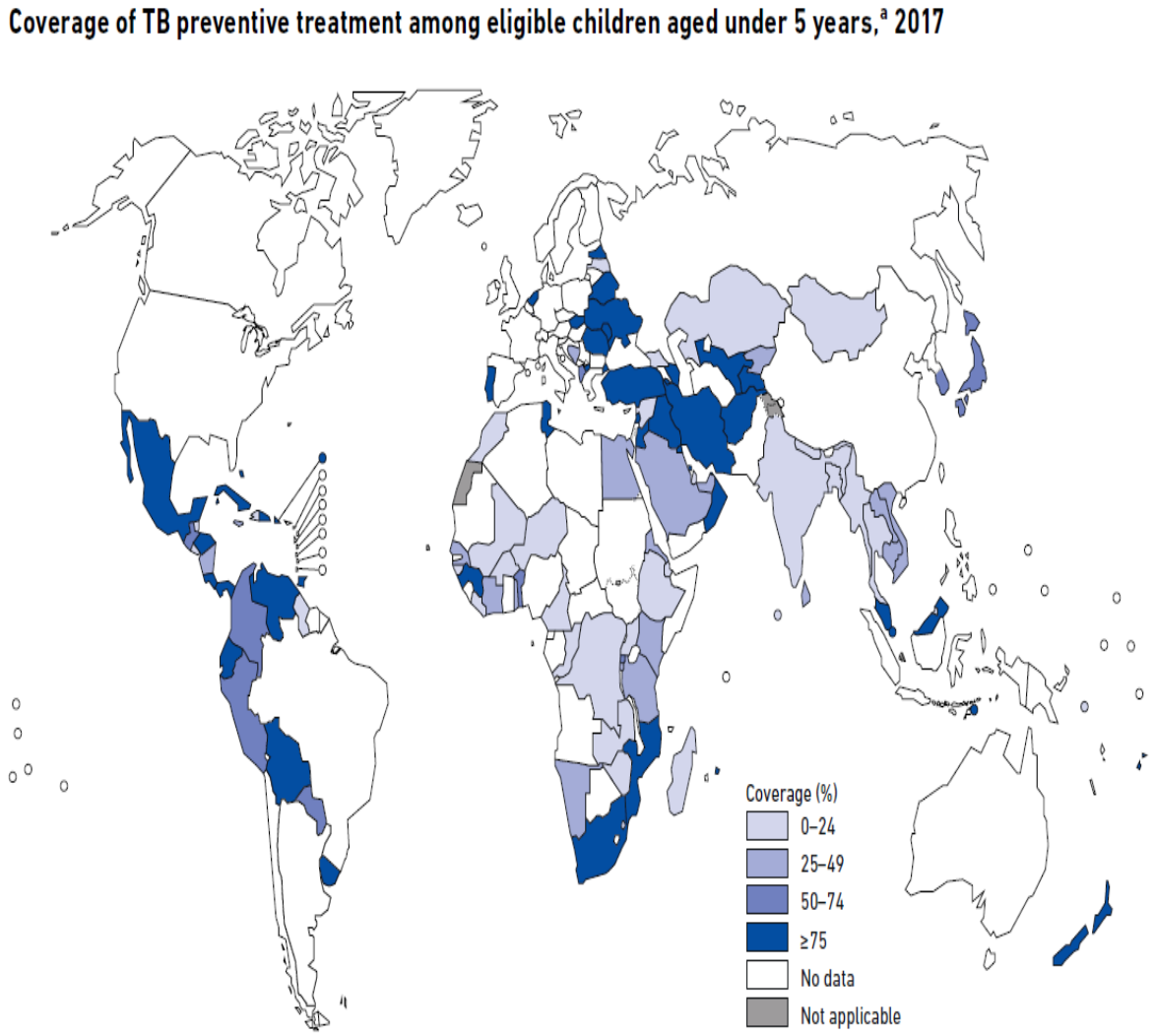

Figure 3: Coverage of TB preventive treatment among eligible children aged under 5 years in 2017 (source: Global TB reports 2018)

2.5 Isoniazid Prevention Therapy

IPT is a chemoprophylaxis which reduces the risk of a first episode of TB occurring in people exposed to infection or with latent infection and the risk a recurrent episode of TB (WHO, 2008). WHO recommends isoniazid taken at a daily dose of 5 mg/kg (maximum 300 mg) for at least six months (WHO, 2008). The main groups eligible for preventive therapy are those at most risk of progressing to TB disease such as people living with HIV (PLHIV, infants and children who are contacts of TB patients and recent TST converters, since the risk of developing active TB is increased in the first few years(WHO, 2008). The risk of developing active TB after infection is determined by various factors including age at exposure, nutritional and immune status, genetic factors, virulence of the organism, and magnitude of initial infection (Swaminathan & Rekha, 2010). In the natural history of childhood intrathoracic TB, primary infection before 2 years of age frequently progresses to disease within the first 12 months (Marais, Gie, Schaaf, Hesseling, Obihara, Starke, et al., 2004). The risk of developing active TB by a child contact can be reduced by nearly 60% with administration of 6 months course of IPT (Ayieko et al., 2014; Tadesse et al., 2016). IPT is safe and efficacious and reduces TB related morbidity by 72% and mortality by 54% (Zar et al., 2007). In Cameroon, only 0.86% (0.79-0.95) of 10300 (9400-11200) child contacts aged < 5 of smear positive TB index cases received preventive treatment in 2017 (WHO, 2018a). In order to improve on the uptake of IPT, the NTP in Cameroon has proposed symptom based screening and evaluation of child contacts using a combination of both Gene-Xpert MTB/RIF and CXR. This is described in the figure below.

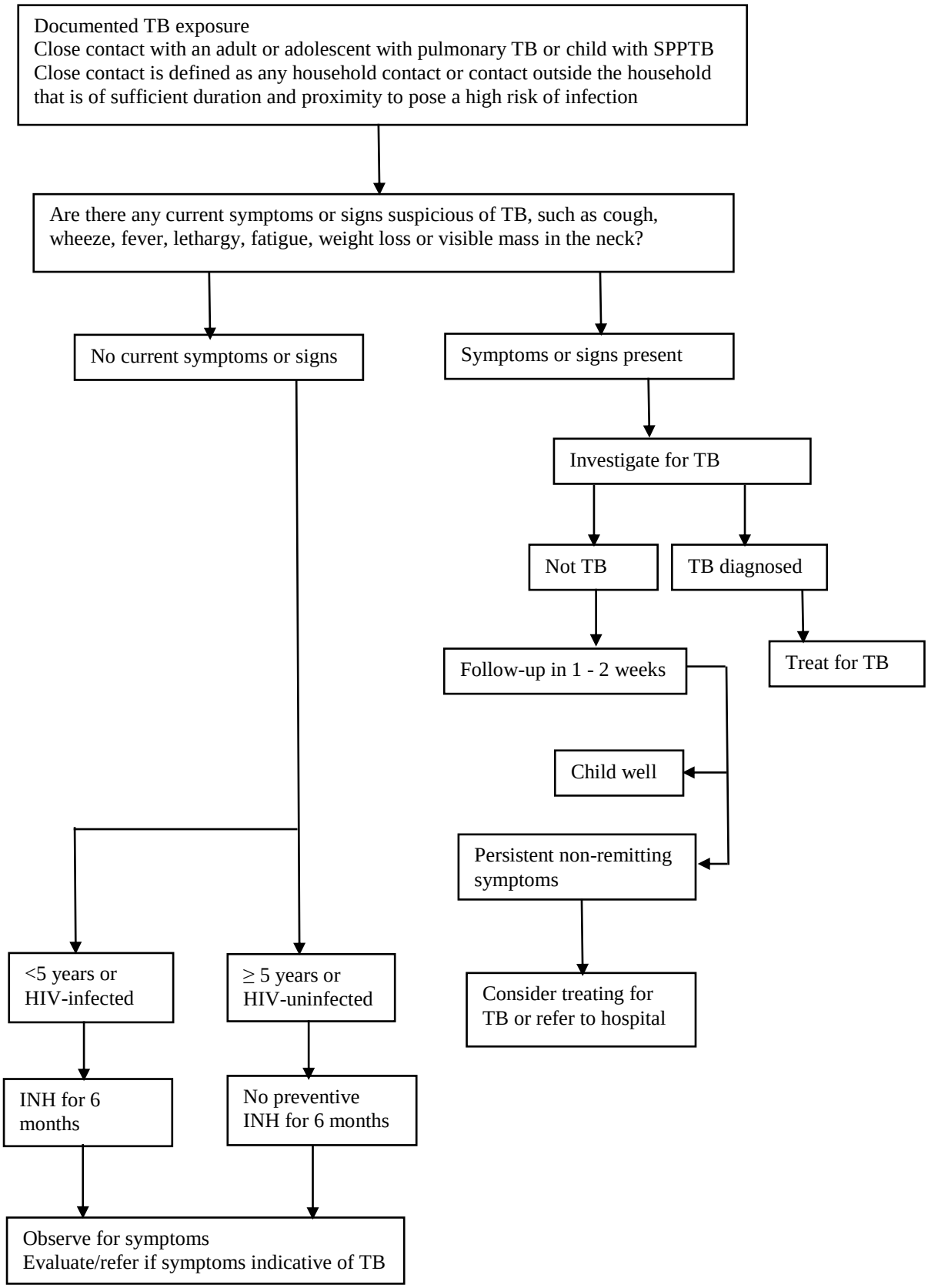

Figure 4: Algorithm for the screening of children exposed to SPPTB

2.6 Factors associated with Isoniazid Preventive Therapy Uptake

Table 1 summarizes findings from global epidemiological studies which assessed IPT uptake and its associated factors amongst child contacts of adult SPPTB patients.

Table 1: Factors associated with Isoniazid Preventive Therapy Uptake in children

Author, year & country	Title	Study design/ Sample size	IPT uptake	Factors associated with IPT uptake	Conclusion
(Black, Amien, & Shea, 2018) South Africa	An assessment of the isoniazid preventive therapy programme for children in a busy primary healthcare Clinic in Nelson Mandela Bay Health District, Eastern Cape Province, South Africa	A cross-sectional descriptive study in which a sample of 246 child contacts was required to obtain adequate power	108/184 (58.7%) started IPT. Only 4 (3.7%) children completed the 24-week IPT course.	Child contacts of male patients and retreatment index patients were less likely to be screened and those who were screened were less likely to initiate IPT	Child contacts were poorly identified and the fall-out of children at each step from identification to IPT completion was unacceptably high.
(Tadesse et al., 2016) Ethiopia	Uptake of Isoniazid Preventive Therapy among Under-Five Children: TB Contact Investigation as an Entry Point	A cross-sectional study including 221 children	64.3% received IPT	80.3% successfully completed six months of therapy.	Contact screening is a good entry point for delivery of IPT to at risk children
(Birungi, Graham, Uwimana, & van Wyk, 2018) Rwanda	Assessment of the Isoniazid Preventive Therapy Uptake and Associated Characteristics: A Cross-Sectional Study	A Cross-sectional Study, 94 child contacts aged less than 5 years	84/94 (89%) were initiated on IPT	Factors associated with no uptake of IPT included children older than 3 years, unfriendly healthcare providers, HIV infected index cases, and the index case not being the child's parent	The National TB Program's policy on IPT delivery was effectively implemented. Future interventions should find strategies to manage factors associated with IPT uptake
(Tucker et al., 2015) South Africa	An assessment of the IPT programme for children in a busy primary healthcare clinic in Nelson Mandela Bay Health District, Eastern Cape Province	A cross-sectional descriptive study design	68.5% started IPT	Of the 261 contacts <5 years identified 70.5% (n=184) were screened	
(Hall et al., 2015) Timor-Leste	Challenges to delivery of isoniazid preventive therapy in a cohort of children exposed to tuberculosis in Timor-Leste	Cohort of 256 consecutive sputum smear-positive TB index cases	46 of 255 (18%) started IPT	Attendance was significantly less likely when the index case was not the parent of the child contact	SPPTB cases frequently result in household exposure of children <5 years in Timor-Leste, and provision of IPT is suboptimal.
(A. R. Singh et al., 2017) India	IPT among Children Living with TB Patients: Is It Working? A Mixed-Method Study from Bhopal, India	A mixed-method study design: quantitative phase followed by qualitative phase	22% children were started & 20% completed IPT.	Lack of awareness, risk perception among parents, cumbersome screening process, isoniazid stock-outs, inadequate knowledge among healthcare providers and poor programmatic monitoring as main barriers to IPT implementation	National TB programme should counsel parents, train healthcare providers, simplify screening procedures, ensure regular drug supply and introduce an indicator to strengthen monitoring and uptake of IPT.

CHAPTER THREE

METHODOLOGY

3.1 Study design

This was a mixed method study involving quantitative and qualitative components. The quantitative component was a cross-sectional study conducted in selected health facilities in the city of Douala located in the littoral region of Cameroon. The medical records of all patients diagnosed with TB from January to July 2019 were reviewed and patients with SPPTB (index cases) were selected. Index cases with documented records of child contacts were selected while those with undocumented records of child contacts were contacted through phone calls to ask if they had child contacts under 5 years. Index cases with child contacts were interviewed during their routine drug refill visits to the health facilities while index cases with farther routine visit dates were contacted and interviewed in their homes. Interviewer administered questionnaires were used to collect data on background, clinical, health facility, community and IPT based characteristics. The qualitative component employed in-depth interviews with the healthcare workers involved in the provision of DOTs and IPT services.

3.2 Study area

The study was conducted in Douala, the economic capital of Cameroon and an urban area with a rapid growing population. It is situated in the Littoral region of Cameroon and has a population of about three million people with a surface area of 20,248 km^2 with a population density of 124/km^2. It is situated in the lowland coast of Cameroon. It has two seasons; the dry season which runs from October to March and the rainy season which runs from April to September. Douala is a metropolitan city with a wide variety of ethnic groups. It has a wide variety of economic activities, ranging from subsistent farming to tertiary activities.

As a consequence of its rapid growth and urbanization, the city's administration is struggling to manage the increasing difficulties of providing basic housing and public services. Douala is the most populated city in Cameroon and reports one of highest prevalence of TB in the

country. Besides the low socioeconomic status and the presence of overcrowding in most neighbourhoods, a lack of human and technical resources also contributes to the incidence of TB in the area. Thus Douala was selected as the study site.

There are over 50 health facilities including primary health centres (PHCs), district, regional and reference hospitals in Douala which provide TB diagnostic and treatment services and represent entry points for TB cases but IPT is not provided in all these health facilities due to lack of TB treatment personnel and inadequate screening equipment. All the TB treatment services in Douala are funded by the state and are either private (faith-based) or state owned health facilities. Most of the TB treatment facilities have two staff members working in TB services. All the staff members are trained in TB management and they provide counselling to parents/caregivers on IPT before their children start the regimen. INH is provided free of charge in Cameroon after child contact tracing and screening to roll out active TB has been done. All TB index cases are offered the opportunity to choose the nearest healthcare facility they wish to receive TB treatment and IPT for their child contacts.

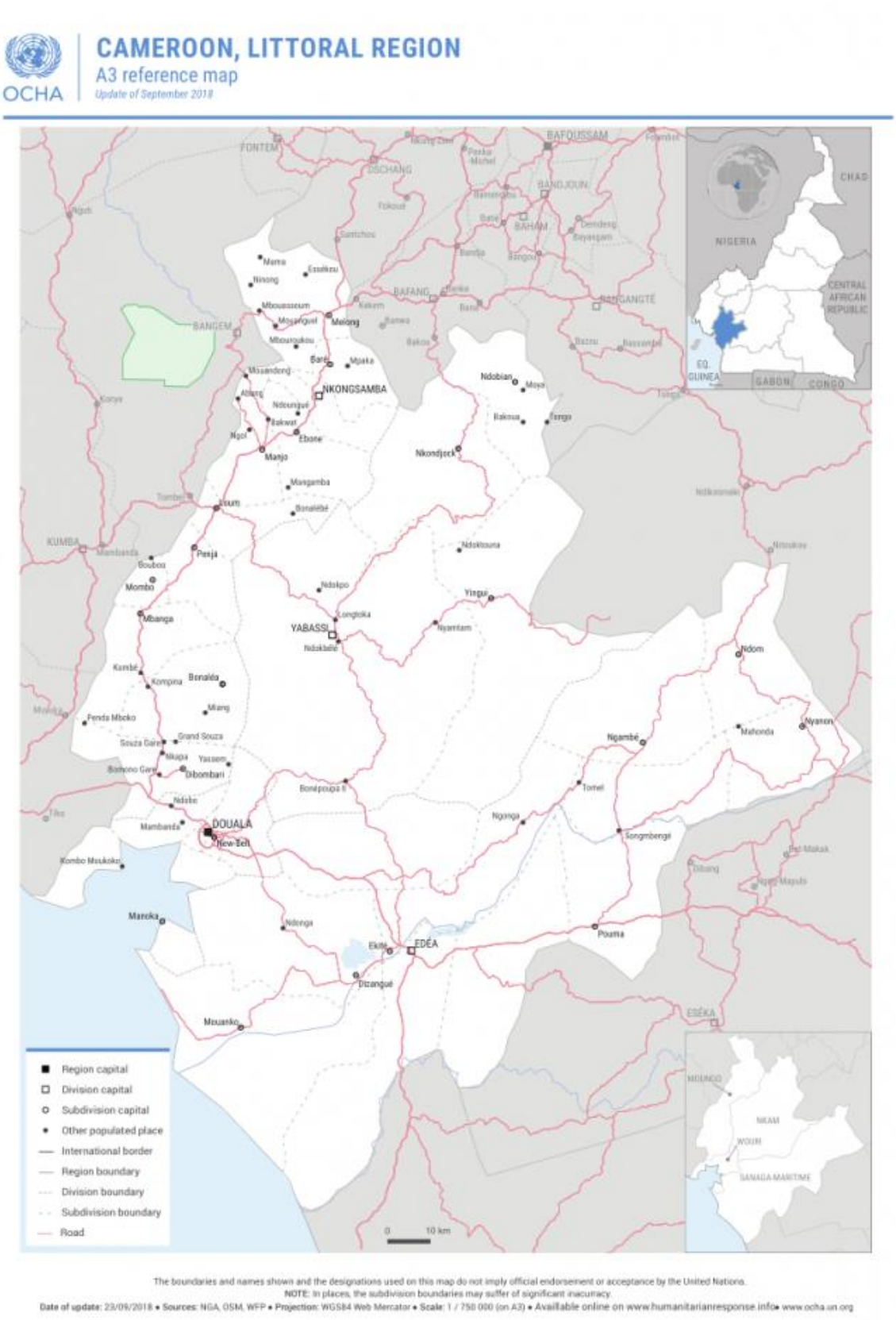

Figure 5: Map of Douala

3.3 Study population

The study population included child contacts of adult patients diagnosed with SPPTB (index cases) from January to July 2019 and also included health workers in selected health facilities who provide DOTs services and implement IPT services. IPT implementation practices in TB treatment health facilities in Douala were similar and they functioned following the guidelines stipulated by Cameroon's NTP. TB Index cases who had at least one child under the age of 5 years were usually informed to bring their children to the health facilities for screening and subsequent provision of INH. The TB nurse usually invites the child during the first visits of the two months intensive phase of TB treatment, using phone calls and text messages as reminders.

3.3.1 Inclusion criteria

Child contacts aged below 5 years who shared the same household with a selected smear positive TB case within 3 months prior to diagnosis were included in this study.

3.3.2 Exclusion criteria

Child contacts aged below 5 years excluded from this study were those who were:

1. Born after the smear positive TB index cases were diagnosed and initiated on TB treatment
2. On TB treatment after screening confirmed active TB
3. Not living in the same household with the index cases before the diagnosis.
4. Child contacts infected with HIV

3.4 Sample size

The sample size was calculated using the single population proportion formula by assuming IPT uptake rate was 50%. (Provide the reference for the formula)

$$n \geq \frac{Z^2_{\left(1-\frac{\alpha}{2}\right)} P(1-P)}{e^2}$$

Where, p was the assumed proportion of eligible children under 5 years who received IPT, e=level of precision (absolute error) of 5% at 5% type 1 error, $Z^2_{\left(1-\frac{\alpha}{2}\right)}$= Standard normal variate for level of significance (α) and was equal to 1.96 at 5% type 1 error. For a 95% confidence interval: z=1.96, p=50% (0.5), d=5% (0.05).

Substituting the values into the equation above, n ≥ **384.2.** After adjusting for the 10% non-response rate, a minimum number of **423** child contacts was to be included in this study.

A total of 7 in-depth interviews (IDIs) was conducted with the health workers.

3.5 Sampling methods

A list of all health facilities (public and private) providing TB treatment and prevention services was obtained from the regional delegate of public health. At the level of the facility, eligible child contacts were conveniently recruited, starting with those facilities reporting the highest number of child contacts eligible for IPT until the required sample size was gotten. Health workers for the IDIs were purposively selected and interviewed using an interview guide.

3.6 Data collection techniques and tools

3.6.1 Quantitative data collection techniques and tools

At the health facilities, the medical records of TB has routine data on child contacts such as the sex and age, whether or not these contacts had been screened and if IPT has been started. For the quantitative component, data were collected in twofold. Firstly, the treatment records of the bacteriologically confirmed TB patients on treatment were reviewed for the selection of participants and eligible TB treatment records were those with registered child contacts under five years. These eligible TB cases were approached either at the hospital upon arrival for

routine anti-TB treatment refill or at the community using the address on the treatment folders. Secondly, informed consent was obtained from the TB cases, the parents or the caregivers of the child contacts under five years before the administration of face to face (interviewer) questionnaire. Lists of relevant questions needed to achieve our study objectives formed the basis for the questionnaire. The questionnaire consisted of the background characteristics of the child contacts, clinical profile of smear positive TB cases, community related characteristics as well as information regarding IPT uptake in relation to the patient and the selected health facilities.

3.6.2 Qualitative data collection techniques and tools

For the qualitative component, in-depth interviews (IDIs) were conducted with 7 health workers including nurses, pharmacists and doctors of the TB treatment facilities by the principal investigator (PI). Purposive sampling was used to select these health care providers. An interviewer guide focused on the implementation processes of IPT amongst child contacts exposed to SPPTB was used for the in-depth interview. In undertaking the interview sessions, a guide containing the following areas was used; personal perspectives to the medication and barriers and/or facilitators of IPT uptake by child contacts of SPPTB. Healthcare workers were pre-informed of the study and invited to be part of the study. Interview guide was pre-tested and no further modification was needed. Participants signed the consent sheet after reading. The interview took place at their workplace and lasted between 20-30 minutes. Interviews were conducted in a hospital setup that was convenient for key informants.

3.7 Variables

Table 2: Sample variables

VARIABLES	OPERATIONAL DEFINITION	MEASUREMENT VALUES
INFORMATION FROM TB TREATMENT FOLDER (VERIFICATION OF INCULSION)		
Smear positive pulmonary tuberculosis (SPPTB) patient	Referred to patients with acid fast bacilli (AFB) microscopically identified during sputum analysis	Categorical Value: Yes/No
Child contacts	Referred to any children under 5 years living in the same house with SPPTB patient within the period of TB diagnosis	Categorical Value: Yes/No
Child contacts screening	Referred to the screening child contact for active TB	Categorical Value: Yes/No
HIV status	Referred to the HIV status of the child contacts as reported in the TB treatment folder	Categorical Values: - Reactive -Non reactive
BACKGROUND OF THE CHILD CONTACT		
Age of child contact	Referred to the age in years of the child contact as reported at the time of TB diagnosis.	Continuous
Gender of child contact	Referred the gender of the child contact as reported at the time of TB diagnosis.	Categorical Value: -Male –Female
School going status of child contact	Referred to whether or not the child contact is in school	Categorical Value: Yes/No
Age of SPPTB patient	Referred to the age in years of the SPPTB patient as reported at the time of TB diagnosis.	Continuous
Gender of SPPTB patient	Referred the gender of the SPPTB patient as reported at the time of TB diagnosis.	Categorical Value: -Male –Female
Occupational status	Referred to whether or not the SPPTB patient is employed as reported at the time of TB diagnosis.	Categorical Value: Yes/No
Financial status	Monthly income of the household in Francs CFA/USD?	Continuous
Educational status	Referred to the educational status mentioned by the SPPTB patient during the interview	Categorical Values: No Formal education, Primary, Secondary, Tertiary
Marital status	Referred to the marital status reported by the SPPTB patient during the interview	Categorical Values: Single, Married, cohabitation, Divorced/ separation/widow.
Religion	Referred to the religious background of the SPPTB patient during the interview	Categorical Values: -Christian -Non-Christian
Residence	Referred to the address or area of residence of the SPPTB patient during the interview	Categorical Values: -Urban –Rural
HOUSEHOLD RELATED FACTORS		
Household density	Referred to the number of people who lived in the same house with the TB case at time of diagnosis	Continuous
Time spent together	Referred to the average time spent per day with contact before diagnosis	Continuous
Roommates	Referred to whether the child contact live in the same bedroom with TB case	Categorical Value: Yes/No
Relationship	Referred to the the child's parental relationship with the TB case	Categorical Values: Parent/Non parent
CLINICAL FACTORS		
Symptomatic child contact	Referred to whether the child is exhibiting symptoms of TB	Categorical Value: Yes/No
HIV status	Referred to the HIV status of the TB case as reported in the TB treatment folder	Categorical Values: -Reactive, -Non-reactive
Previous TB treatment history	Referred to the previous history of TB treatment received by TB case	Categorical Values: -First time, -Retreatment
AFB positive smear classification on microscopy	Referred to the quantity of acid fast bacilli (AFB) seen on sputum microscopy of the TB case?	Categorical Values: +1 (1-9/100 fields) +2 (1-9/10 fields) +3 (3=1-9/field) +4 (>9/field)

Previous IPT use by child	Referred to whether the child have a history of previous use of Isoniazid Preventive Treatment	Categorical Values: Yes/No
HEALTH FACILITY RELATED FACTORS		
Provider/patient relationship	Referred to the nature of the Provider/patient relationship	Categorical Values: good/poor
Child contact screening	Referred to whether the child contact was screened to roll out active TB disease	Categorical Value: Yes/No
Child contact tracing	Referred to whether the child contact was traced to their home in the community	Categorical Value: Yes/No
Assess to TB screening services	Referred to whether the health facility offer free TB screening services such as sputum smearing, tuberculin skin test, chest x-ray and gene Xpert	Categorical Value: Yes/No
Health facility type	Referred to the type of health facility	Categorical Values: -Public -Private/faith based
COMMUNITY FACTORS		
Fear of acquiring TB	Referred to whether the TB case fears the child contact may acquire TB	Categorical Value: Yes/No
Fear of stigmatization	Referred to whether the TB case fears the child contact will be stigmatized by the community for having TB	Categorical Value: Yes/No
Reluctance to take medication in the absence of symptoms	Referred to the reluctance to take medication in the absence of symptoms	Categorical Value: Yes/No
Accessibility of health facility to the community	Referred to whether the TB cases can easily afford money for transport to the facility	Categorical Value: Yes/No
ISONIAZID PREVENTIVE THERAPY FACTORS		
Pill burden	Referred to whether to INH pill is too large for ingestion by the child contact	Categorical Value: Yes/No
Drug side effect	Referred to the presence of at least one drug side effects	Categorical Value: Yes/No
Irregular isoniazid supply/ Isoniazid stock out	Referred to whether the provision of INH is irregular and sometimes out of stock	Categorical Value: Yes/No
Poor adherence	Referred to whether to child contacts fail to take it drug daily as prescribed	Categorical Value: Yes/No
OUTCOME OF IPT		
IPT uptake	Referred to whether the child contact received IPT	Categorical Value: Yes/No
IPT default/dropout	Referred to whether the child contact default from treatment at point in time (drop out)	Categorical Value: Yes/No
IPT completion	Referred to whether the child contact completed the six months course of IPT	Categorical Value: Yes/No
IPT adherence	Referred to whether the child contact missed some doses of the treatment	Categorical Value: Yes/NO

3.8 Data Processing and Data Management.

Questionnaires were attributed serial numbers that will help match them to the database if there was need for cross-verification and then the data were entered into an electronic data entry form by the research assistants under the supervision of the primary investigator. The dataset was stored in personal laptop with several backups such as drop-box and Google drive if in case primary storage fails.

3.9 Data analysis

3.9.1 Quantitative data analysis

Quantitative data were entered into SPSS version 23, cleaned and then exported into STATA version 15.0 for analysis. The dependent variables in this study were IPT uptake. Continuous variables were categorized or presented as case summaries using measures of central tendency (Mean or Median) and measures of dispersion (Standard Error of mean, Standard Deviation, Minimum and Maximum values). Univariate analysis was performed to determine the proportion of child contacts that had received IPT. Bivariate analysis was employed using Chi-square or Fisher exact test for categorical variables. Logistic regression was also used to investigate factors independently associated with IPT uptake. Firstly, the association between outcome (IPT uptake and completion) and independent variables (demographics, TB index case, child contact, health facility and IPT drug related factors) was examined. Then each dependent variable with a P-value was less than 0.05 was included in the logistic regression analysis. All statistics were discussed at the 95% confidence interval (CI), and the level of significance was set at $P<0.05$.

3.9.2 Qualitative data analysis

The audio taped interviews were transcribed verbatim and the transcripts were later prepared and imported into QSR Nvivo 10 software to facilitate data coding and analysis. The coding process involved a critical review of each transcript and coding of the data into emerging themes. These codes were generated inductively from participants' perspective of the facilitators and barriers to IPT uptake. Memos were created in the Nvivo 10 software and

attached to themes during the coding process. This was to help put down preliminary ideas and observations from the data and patterns that emerged from the data for thematic content analysis. The results were presented as narratives and supported by relevant quotes from the transcripts. Following initial coding of transcripts, preliminary themes that captured information relevant to the research questions were generated. The thematic analysis process involved identifying patterns in the data: recurring ideas, perspectives and descriptions that depicted each participant's context and perspective. The final analysis for this study focused on the key themes, narratives, and professional histories emerging from the interviews. Data concordance was verified by a trained qualitative researcher with extensive experience in medical and public health qualitative research. Thematic saturation was achieved as similar themes that emerge from various participants from each target group after preliminary analysis of initial interviews. Quotes that best illustrate important representation of participants' views and experiences were identified through our iterative process of review and discussions were presented in the results section.

3.10 Quality control

3.10.1 Recruitment and training of research assistants

To assist in effective data collection, five research assistants who were both English and French speaking were selected and trained to appreciate the aims and objectives of the study. This training lasted for 2 days and included practical sessions that highlighted the keys issues. The PI also took the research assistants through ethical issues and code of conduct in the field.

3.10.2 Pretesting of questionnaire

The questionnaire was pre-tested to ensure that the data collection tool is validated and research assistants conversant with the tool before the actual data collection. Pre-testing the tool was helpful in refining different aspects of the study including fieldwork procedures and data collection tool.

3.10.3 Supervision

The PI supervised every step of the data collection process in order to explain certain issues not understand well by research assistants and to ensure that ethical issues are fully respected.

3.10.4 Data entering

Each day, data were checked to ensure that all information was properly filled. Errors and omissions detected were discussed with and adjusted by the research assistants. Data were double entered into the electronic data entry form using SPSS version 23 to ensure that data were correctly entered.

3.11 Ethical Consideration.

Ethical clearance was obtained from the Ghana Health Service Ethics Committee and then from the Ethics Review Committee of the University of Douala, Cameroon. Administrative approval and authorization was be gotten from the Regional Delegate of Public Health of Littoral, the coordinator of TB prevention program of Littoral, the District Medical Officers of the various health districts involved and the Chief Medical officers of the selected health facilities. This was done by writing application letters to the mentioned authorities.

CHAPTER FOUR

RESULTS

4.0 Recruitment of study participants

We reviewed the folders of 1409 index cases diagnosed with SPPTB in 9 selected treatment facilities in Douala from January 1st to July 5th 2019. A total of 461 index cases who met the inclusion criteria were selected and invited to participate in this study. Of this 461 index cases, 304 consented to participate and were then included in this study. A total of 513 child contacts were identified from 304 index cases assessed. Figure 6 shows the inclusion of study participants.

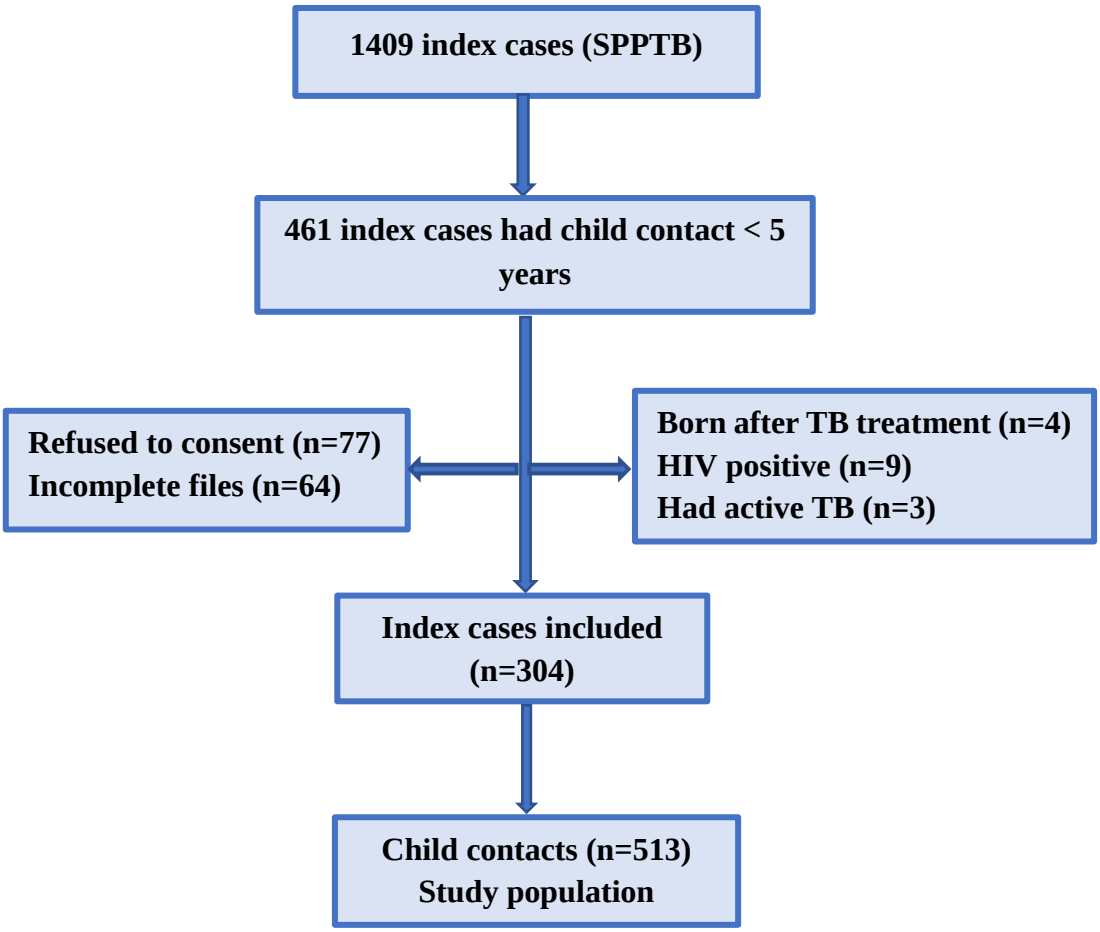

Figure 6: Inclusion of study participants

4.1 Background characteristics of study participants

4.1.1 Sociodemographic characteristics of TB index cases

Table 3: Sociodemographic characteristics of TB index cases

Variables	Frequency (n)	Percentage (%)
Sex		
Female	247	48.1
Male	266	51.9
Age groups of index cases (in years)		
≤ 20	57	11.1
21-30	161	31.4
31-40	155	30.2
41-50	73	14.2
> 50	67	13.1
Employment status		
Unemployed	263	51.3
Employed	250	48.7
Marital status		
Married	245	47.8
Single	223	43.4
Widow(er)	27	5.3
Divorced	18	3.5
Religion		
Christians	421	82.1
Non-Christians	92	17.9
Area of residence		
Urban	372	72.5
Rural	141	27.5
Level of education		
None	62	12.1
Primary	120	23.4
Secondary	243	47.4
Tertiary	88	17.2

Table 3 shows the sociodemographic characteristics of index cases included in this study. In this study, more than half of the TB index cases were males (51.9%). The age of the index cases ranged from 11 to 83 years with a mean age (SD) of 35.24 (13.11) year. When age was categorized, those aged 21-30 and 31-40 were most frequent (31.4% and 30.2% respectively). Of the 513 child contacts, majority were not employed (51.3%), married (47.8%), Christians (82.1%), resident in the urban part of Douala (72.5%) and had attained secondary education (47.4%).

4.1.2 Sociodemographic characteristics of child contacts

Table 4: Sociodemographic characteristics of child contacts

Variables	Frequency (n)	Percentage (%)
Sex of child contacts		
Female	250	48.7
Male	263	51.3
Age groups of child contacts (in months)		
≤ 12	85	16.6
13-24	79	15.4
25-36	88	17.2
37-48	118	23.0
> 48	143	27.9
Child in school		
Child not in school	278	54.2
Child in school	235	45.8

Table 4 shows the sociodemographic characteristics of the child contacts included in this study. In this study, half of the child contacts were males (51.3%) with male to female child contact ratio of 1:1. The age range was from 1 to 59 months with a mean age (standard deviation (SD)) of 35.25 (17.45) months. When age was categorized, child contacts aged > 48 months were most frequent (27.9%). Of the 513 child contacts, 235 were in school (45.8%).

4.1.3 Household characteristics of child contacts

Table 5: Household characteristics of child contacts

Variables	Frequency (n)	Percentage (%)
Child share the same room with TB index case		
Don't share the same room	245	47.8
Share the same room	268	52.2
TB index case relationship with child contact		
Non parent	236	46.0
Parent	277	54.0
Household density (number of household members)		
< 5	106	20.7
5-8	285	55.6
> 8	122	23.8
Time spent per day with TB index case (in hours)		
< 9	227	44.2
9-16	217	42.3
> 16	69	13.5

Table 5 shows the household characteristics of child contacts included in this study. In this study, 268 (52.2%) child contacts shared the same room with the index cases while more than half of the child contacts were exposed to TB by their parents (54.0%). The household density ranged from 1-30 members with an average of 7 household members and when categorized, majority of household had 5-8 members (55.6%). The time spent per day with TB index case by child contact ranged from 1-24 hours with a mean time of 10.3±5.8 hours and when categorized, majority of child contacts spent < 9 hours per day with their index cases (44.2%).

4.2 Clinical characteristics of study participants

Table 6: Clinical characteristics of study participants

Variables	Frequency (n)	Percentage (%)
Type of index case		
New case	479	93.4
Retreatment case	34	6.6
HIV status of index case		
Negative	405	78.9
Positive	108	21.1
Number of AFB seen on Sputum microscopy results		
1-9 AFB/100 fields (1+)	198	38.6
10-99 AFB/100 fields (2+)	182	35.5
1-10 AFB/field (3+)	100	19.5
> 10 AFB/field (4+)	33	6.4
MDR-TB		
Negative	472	92.0
Positive	41	8.0
Presence of TB suggestive symptoms		
No TB symptoms present	448	87.3
Has at least one TB symptom	65	12.7
TB suggestive symptoms during screening		
Cough	40	58.0
Fever	23	33.3
Appetite loss	3	4.3
Excessive/night sweats	2	2.9
All	1	1.4
Previous use of IPT		
Has no previous use of IPT	495	96.5
Has previous use of IPT	18	3.5

IPT: Isoniazid preventive therapy; MDR-TB: multiple drug resistant tuberculosis

The clinical characteristics of study participants has been shown in the table above. Of the 513 participants in this study, 479 (93.4%) index cases were new cases, 108 (21.1%) were HIV seropositive, had rare acid fast bacilli (AFB) on sputum microscopy (38.6%) and 41 (8.0%) had multiple drug resistant (MDR) TB. In this study, 18 (3.5%) child contacts had a history of previous IPT use while 65 (12.7%) child contacts presented with symptoms suggestive of TB amongst which cough was most frequent (58.0%).

4.3 TB treatment health facility based characteristics of the study participants

Table 7: TB treatment health facility based characteristics

Variables	Frequency (n)	Percentage (%)
Index case/health worker relationship		
Bad	75	14.6
Good	438	85.4
Child contact tracing		
Not traced	319	62.2
Traced	194	37.8
Child contact Screening		
Not screened for TB	386	75.2
Screened for TB	127	24.8
Incur screening cost		
Did not pay for screening	473	92.2
Paid for screening	40	7.8
Health facility with free screening services (CXR and gene Xpert)		
No free screening offered	292	56.9
Free screening offered	221	43.1
Type of TB treatment health facility		
Private/faith based	103	20.1
Public	410	79.9
Education on the benefits and need for IPT use		
Not educated on IPT	205	40.0
Educated on IPT	308	60.0

CXR: Chest X ray; IPT: Isoniazid preventive therapy; A good index case/health worker relationship is one in which the patient is always well treated with no form of discrimination and stigmatization and a bad index case/health worker relationship is one in which patient feels he/she was discriminated and stigmatized by the health worker.

The TB treatment health facility based characteristics of the study participants is shown in table 7. Majority of the index cases reported to have to good relationship with the health workers (85.4%). Of the 513 child contacts identified, 194 (37.8%) were traced back to their homes, 127 (24.8%; 95% CI: 21.2-28.7) screened and 40 (7.8) paid for the screening test. Majority of TB index cases and their child contacts were seen in public hospitals (79.9%) and 221 (43.1%) child contacts were offered free screening services. In this study, only 308 (60.0%) were educated on the benefits and need for IPT use by their child contacts.

4.4 Community related characteristics of study participants

Table 8: Community related characteristics of study participants

Variables	Frequency (n)	Percentage (%)
Fear of acquiring TB		
Not afraid child will get TB	287	55.9
Afraid child will get TB	226	44.1
TB related stigma		
Not worried about TB related stigma	401	78.2
Not worried about TB related stigma	112	21.8
Community based education on IPT use		
Not educated on IPT during home visit	427	83.2
Educated on IPT during home visit	86	16.8
Reluctance to receive IPT		
Not reluctant to receive IPT	414	78.2
Reluctant to receive IPT	99	19.3
Accessibility of health facility		
Health facility not accessible	170	33.1
Health facility accessible	343	66.9

IPT: Isoniazid preventive therapy

The fear of acquiring active TB, stigma associated with TB, reluctance to accept IPT and accessible TB treatment facilities was seen in 44.1%, 21.8%, 16.8%, 19.3% and 66.9% respectively.

4.5 IPT uptake amongst child contacts exposed to smear positive pulmonary TB

4.5.1 Prevalence of IPT uptake amongst eligible child contacts

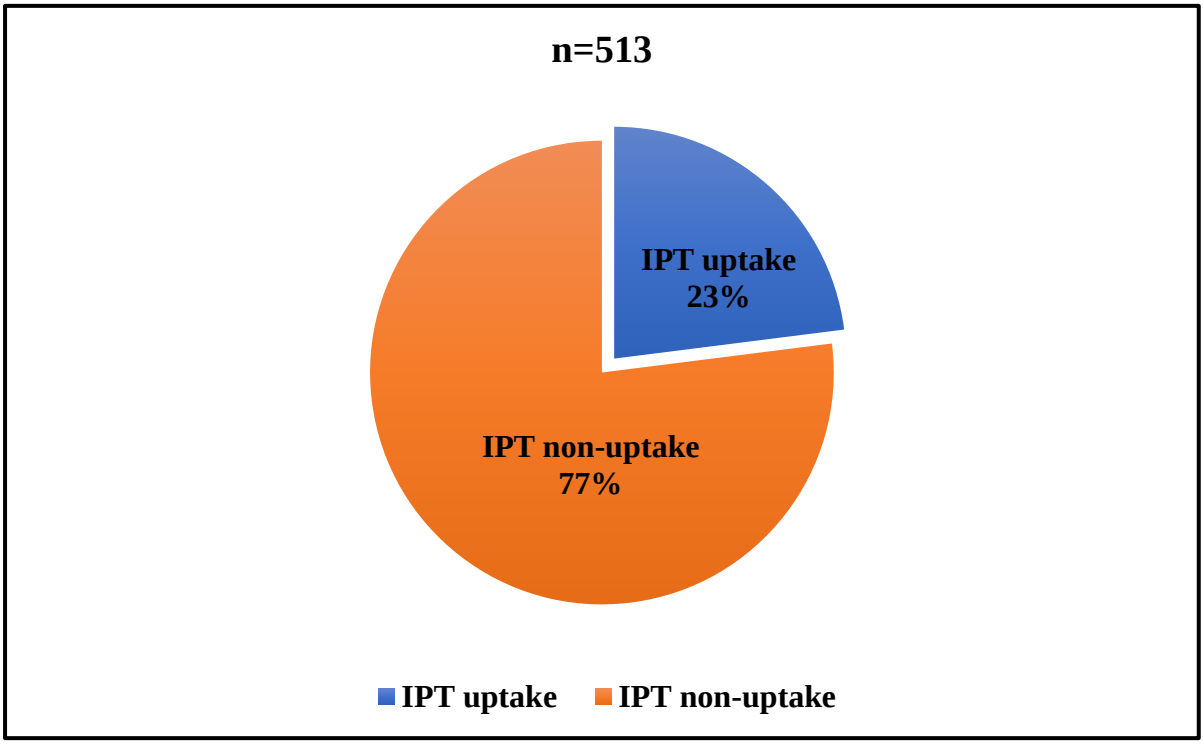

Figure 7: Proportion of IPT uptake amongst child contacts exposed to Tuberculosis

Of the 513 child contacts identified, 23.0% (118/513) received isoniazid (INH) with a 95% confidence interval of 19.6-26.9%.

4.5.2 IPT outcome and related characteristics

Table 9: IPT outcome and related characteristics

Variables	Frequency (n)	Percentage (%)
Adherence to IPT		
Poor adherence	60	50.8
Good adherence	58	49.2
Defaulted on IPT		
Did not default	77	65.3
Defaulted	41	34.7
IPT completion		
Not completed	106	89.8
Completed IPT	12	10.2
IPT failure		
Did not failure	117	99.2
Failed IPT	1	0.8
Interrupted IPT use by health worker due to side effects		
IPT not interrupted	117	99.2
IPT interrupted	1	0.8
Pill burden		
Not worried about large pill size	95	80.5
Worried about large pill size	23	19.5
Prolonged INH intake		
Not worried about prolonged INH intake	90	76.3
Worried about prolonged INH intake	28	27.3
INH side effects		
No Worried about the side effects of INH	99	83.9
Worried about the side effects of INH	19	16.1
INH supply at the health facility		
Not regular	12	10.2
Regular	106	89.8
IPT stock out		
No stock out	115	97.5
Stock out	3	2.5

IPT: Isoniazid preventive therapy; INH: Isoniazid

Of the 118 child contacts who received INH, poor INH adherence was seen in 49.2% while 41 (34.8 %) child contacts defaulted (loss to follow up). Only 2 (1.7%) child contacts completed the 6 months course of INH (IPT completion) while one child contact (0.8%) developed active TB in the within 3 months of IPT uptake (IPT failure). Majority of child contacts (89.8%) received regular INH supply at each visit to the TB treatment facility and while 3 (2.5%) child contacts could not receive IPT because it was out of stock (IPT stock out). Of the 118 child contacts who received INH, 19 (16.1%) experienced side effects and INH was interrupted in one child contact (1.7%) because of undesirable side effects.

4.6 Factors associated with IPT uptake amongst child contacts

4.6.1 Background characteristics associated with IPT uptake amongst child contacts

Table 10: IPT outcome and related characteristics

Variables	Category	IPT (-) n (%)	IPT (+) n (%)	X^2 (df)	P value
Sex of child contact	Girl	187 (47.3)	63 (53.8)	1.330 (1)	0.249
	Boy	208 (52.7)	55 (46.6)		
Age groups of child contact in months	≤12	71 (18.0)	14 (11.9)	4.819 (4)	0.306
	13-24	59 (14.9)	20 (16.9)		
	25-36	72 (18.2)	16 (13.6)		
	37-48	87 (22.0)	31 (26.3)		
	>48	106 (26.8)	37 (31.4)		
Child contact in school	No	218 (55.2)	60 (50.8)	0.690 (1)	0.406
	Yes	177 (44.8)	58 (49.2)		
Sex of index case	Female	188 (47.6)	59 (50.0)	0.211 (1)	0.646
	Male	207 (52.4)	59 (50.0)		
Age groups of TB index patients in years	≤20	48 (12.2)	9 (7.6)	23.209 (4)	<0.001
	21-30	107 (27.1)	54 (45.8)		
	31-40	116 (29.4)	39 (33.1)		
	41-50	63 (15.9)	10 (8.5)		
	>50	61 (15.4)	6 (5.1)		
Employment status	Unemployed	203(51.4)	60(50.8)	0.011 (1)	0.917
	Employed	192 (48.6)	58 (49.2)		
Marital status	Married	189 (47.8)	56 (47.2)	0.246 (3)	0.970
	Single	172 (43.5)	51 (43.2)		
	Widowed	21 (5.3)	6 (5.1)		
	Divorced	13 (3.3)	5 (4.2)		
Religion	Christian	323 (81.8)	98 (83.1)	0.101 (1)	0.751
	Non-Christians	72 (18.2)	20 (16.9)		
Area of residence	Urban	294 (74.4)	78 (66.1)	3.162 (1)	0.076
	Rural	101 (25.6)	40 (33.9)		
Level of education	Illiterate	51 (12.9)	11 (9.3)	3.196 (3)	0.362
	Primary	93 (23.5)	27 (22.9)		
	Secondary	189 (47.8)	54 (45.8)		
	Tertiary	62 (15.7)	26 (22.0)		
Child share the same room with index case	Don't live in same room	204 (51.6)	41 (34.7)	10.401 (1)	0.001
	Live in same room	191 (48.4)	77 (65.3)		
Household density	<5	71 (18.0)	35 (29.7)	9.143 (1)	0.010
	5-8	222 (56.2)	63 (53.4)		
	>8	102 (25.8)	20 (16.9)		
Time spent with child	≤8	194 (49.1)	33 (28.0)	16.712 (2)	<0.001
	9-16	154 (39.0)	63 (53.4)		
	>16	47 (11.9)	22 (18.6)		
Relationship of child with index case	Nonparent	203 (51.4)	33 (28.0)	20.073 (1)	<0.001
	Parent	192 (48.6)	85 (72.0)		

Table 10 shows the relationship between background characteristics and IPT uptake amongst child contacts. The age of TB index cases (p<0.001), sharing the same room with child contacts (p=0.001), the household density (p=0.010), time spent with child contacts (p<0.001) and child's relationship with the index case (p<0.001) were background factors significantly associated with IPT uptake on chi square analysis.

4.6.2 Clinical characteristics associated with IPT uptake amongst child contacts

Table 11: Clinical characteristics associated with IPT uptake amongst child contacts

Variables	IPT (-) n (%)	IPT (+) n (%)	X^2 (df)	P value
Type of index case				
New case	370 (93.7)	109 (92.4)	0.247 (1)	0.619
Retreatment case	25 (6.3)	9 (7.6)		
HIV status				
Negative	305 (77.2)	100 (84.7)	3.100 (1)	0.078
Positive	90 (22.8)	18 (15.3)		
Number of AFB seen on Sputum microscopy results				
1-9 AFB/100 fields (1+)	165 (41.8)	33 (28.0)	20.680 (1)	<0.001
10-99 AFB/100 fields (2+)	135 (34.2)	47 (39.8)		
1-10 AFB/field (3+)	79 (20.0)	21 (17.8)		
> 10 AFB/field (4+)	16 (4.1)	17 (14.4)		
MDR-TB				
Negative	360 (91.1)	112 (94.4)	1.762 (1)	0.190
Positive	35 (8.9)	6 (5.1)		
Presence of TB suggestive symptom				
No TB symptoms present	346 (87.6)	102 (86.4)	0.109 (1)	0.741
Has at least one TB symptom	49 (12.4)	16 (13.6)		
Previous use of ITP				
Has no previous use of IPT	381 (96.5)	114 (96.6)	0.006 (1)	0.936
Has previous use of IPT	14 (3.5)	4 (3.4)		

HIV: Human immunodeficiency virus; MDR-TB: Multiple drug resistance TB; AFB: Acid fast bacilli; IPT: Isoniazid preventive therapy

Table 11 shows the relationship between clinical characteristics and IPT uptake amongst child contacts. Only the sputum microscopy results was significantly associated with IPT uptake amongst child contacts (p<0.001).

4.6.3 Hospital-based factors associated with IPT uptake amongst child contacts

Table 12: Hospital-based factors associated with IPT uptake amongst child contacts

Variables	IPT (-) n (%)	IPT (+) n (%)	X^2 (df)	P value
Index case/health worker relationship				
Bad	65 (16.5)	10 (8.5)	4.636 (1)	0.035
Good	330 (83.5)	108 (91.5)		
Contact tracing				
Not traced	295 (74.7)	24 (20.3)	114.108 (1)	<0.001
Traced	100 (25.3)	94 (79.7)		
Contact screening				
Not screened for TB	349 (88.4)	37 (31.4)	158.465 (1)	<0.001
Screened for TB	46 (11.6)	81 (68.6)		
Incur screening cost				
Did not pay for screening	371 (93.9)	102 (86.4)	7.077 (1)	0.010
Paid for screening	24 (6.1)	16 (13.6)		
Available/Free TB screening services at the treatment facilities				
No free screening offered	262 (66.3)	30 (25.4)	61.999 (1)	<0.001
Free screening offered	133 (33.7)	88 (74.6)		
Type of health facility				
Private	79 (20.0)	24 (20.3)	0.007 (1)	0.936
Public	316 (80.0)	94 (79.7)		
Education on the benefits of ITP during TB treatment				
Not educated on IPT	184 (46.6)	21 (17.8)	31.379 (1)	<0.001
Educated on IPT	211 (53.4)	97 (82.2)		

Table 12 shows the relationship between hospital-based characteristics associated with IPT uptake amongst child contacts using chi square analysis. Index case/health worker relationship ($p=0.035$), child contact tracing ($p<0.001$), child contact screening ($p<0.001$), free/available TB screening services at treatment facility ($p<0.001$), incurring screening cost ($p=0.010$), and education on the benefits of ITP during TB treatment ($p<0.001$) were hospital-based factors significantly associated with IPT uptake.

4.6.4 Community-based factors associated with IPT uptake amongst child contacts

Table 13: Community-based factors associated with IPT uptake amongst child contacts

Variables	IPT (-) n (%)	IPT (+) n (%)	X^2 (df)	P value
Fear of acquiring TB				
Not afraid child will get TB	249 (63.0)	38 (32.2)	35.050 (1)	<0.001
Afraid child will get TB	146 (37.0)	80 (67.8)		
Experience TB related stigma				
Not worried about TB related stigma	330 (83.5)	71 (60.2)	29.089 (1)	<0.001
Worried about TB related stigma	65 (16.5)	47 (39.8)		
Educated on the need for IPT at the community level				
Not educated on IPT during home visit	332 (84.1)	95 (80.5)	0.817 (1)	0.367
Educated on IPT during home visit	63 (15.9)	23 (19.5)		
TB patients' reluctance to enroll child for IPT				
Not reluctant to receive IPT	323 (81.8)	91 (77.1)	1.263 (1)	0.262
Reluctant to receive IPT	72 (18.2)	27 (22.9)		
Accessibility of Health facility to TB patient				
Health facility not accessible	146 (37.0)	24 (20.3)	11.331 (1)	0.001
Health facility accessible	249 (63.0)	94 (79.7)		

Table 13 shows the relationship between community-based characteristics associated with IPT uptake amongst child contacts using chi square analysis. Fear of acquiring TB ($p<0.001$), experiencing TB related stigma ($p<0.001$) and accessibility of health facility ($p<0.001$) were community related factors significantly associated with IPT uptake amongst child contacts.

4.7 Factors independently associated with IPT uptake amongst child contacts

4.7.1 Background characteristics independently associated with IPT uptake

Table 14: Background characteristics independently associated with IPT uptake

Variables	Category	Bivariate analysis		Multivariate analysis	
		aOR (95% CI)	P value	cOR (95% CI)	P value
Sex of child contact	Female	1.274 (0.844-1.924)	0.249	1.720 (0.785-3.771)	0.175
	Male	Ref	Ref	Ref	Ref
Age groups of child contacts	≤12	Ref	Ref	Ref	Ref
	13-24	1.719 (0.800-3.696)	0.165	2.120 (0.482-9.331)	0.320
	25-36	1.127 (0.512-2.480)	0.766	1.213 (0.259-5.687)	0.806
	37-48	1.807 (0.893-3.656)	0.100	3.576 (0.866-14.763)	0.078
	>48	1.770 (0.893-3.510)	0.102	3.937 (0.859-18.040)	0.078
Child contact in school	Not schooling	Ref	Ref	Ref	Ref
	Schooling	1.191 (0.789-1.797)	0.406	1.047 (0.377-2.912)	0.930
Sex of index case	Female	Ref	Ref	Ref	Ref
	Male	0.908 (0.602-1.370)	0.646	1.746 (0.733-4.157)	0.208
Age groups of TB patient	≤20	1.906 (0.635-5.727)	0.245	7.478 (0.687-81.359)	0.099
	21-30	**5.131 (2.086-12.622)**	**<0.001**	**34.712 (4.801-250.998)**	**<0.001**
	31-40	**3.418 (1.371-8.523)**	**0.008**	**10.094 (1.472-69.200)**	**0.019**
	41-50	1.614 (0.553-4.712)	0.381	5.445 (0.717-41.338))	0.101
	>50	Ref	Ref	Ref	Ref
Employment status	Unemployed	Ref	Ref	Ref	Ref
	Employed	1.022 (0.677-1.542)	0.917	0.645 (0.230-1.813)	0.406
Marital status	Married	0.770 (0.263-2.254)	0.634	0.260 (0.018-3.746)	0.323
	Single	0.771 (0.262-2.265)	0.636	0.463 (0.030-7.144)	0.581
	Widowed	0.743 (0.188-2.934)	0.671	7.578 (0.323-177.785)	0.208
	Divorced	Ref	Ref	Ref	Ref
Religion	Christian	1.092 (0.634-1.883)	0.751	1.101 (0.328-3.697)	0.876
	Muslim	Ref	Ref	Ref	Ref
Area of residence	Urban	Ref	Ref	Ref	Ref
	Rural	1.493 (0.958-2.325)	0.076	0.588 (0.203-1.701)	0.327
Level of education	Illiterate	Ref	Ref	Ref	Ref
	Primary	1.346 (0.617-2.936)	0.455	0.450 (0.084-2.413)	0.351
	Secondary	1.325 (0.646-2.717)	0.443	2.478 (0.613-10.014)	0.203
	Tertiary	1.944 (0.877-4.312)	0.102	1.686 (0.323-8.807)	0.536
Share the same room	Don't share	Ref	Ref	Ref	Ref
	Share	**2.006 (1.308-3.075)**	**0.001**	**3.939 (1.399-11.092)**	**0.009**
Household density	<5	2.514 (1.343-4.708)	**0.004**	2.525 (0.664-9.593)	0.174
	5-8	1.447 (0.831-2.521)	0.192	1.916 (0.622-5.902)	0.257
	>8	Ref	Ref	Ref	Ref
Time spent with child	≤8	Ref	Ref	Ref	Ref
	9-16	2.405 (1.501-3.853)	**<0.001**	1.256 (0.472-3.338)	0.647
	>16	2.752 (1.471-5.149)	**0.002**	2.534 (0.621-10.340)	0.195
Child's relation with patient	Nonparent	Ref	Ref	Ref	Ref
	Parent	2.723 (1.740-4.262)	**<0.001**	2.142 (1.070-4.286)	**0.031**

aOR: unadjusted odds ratio; cOR: adjusted odd ratios; CI: confidence interval; Ref: reference category

Table 14 shows the background factors that are independently associated with IPT uptake amongst child contacts. On bivariate analysis, significant associations were observed between IPT uptake and the age of TB index cases, sharing the same room with child contacts, the household density, time spent with child contacts and child's relationship with the index case were background factors significantly associated with IPT uptake on bivariate analysis. On multivariate analysis, age of the index cases, sharing the same room as index case and the TB patient being parents of the child contact remained significantly associated IPT uptake.

Index cases aged 21-30 years were 34.7 times more like to enroll their contacts for IPT uptake compared to those aged > 50 years [OR=34.712; (95% CI: 4.801-250.998); p<0.001] while index cases aged 31-40 years were 10 times more like to enroll their contacts for IPT uptake compared to those aged > 50 years [OR=10.094; (95% CI: 1.472-69.200); p=0.019].

Child contacts sharing the same room with index cases were 4 times more likely to receive IPT compared to those who did not share the same room [OR=3.939; (95% CI: 1.399-11.092); p=0.009].

Children exposed to TB through contact with their parents about 2.1 times more likely to receive IPT compared to those exposed to TB through contact with nonparents [OR=2.142 ; (95% CI: 1.070-4.286); p=0.031].

4.7.2 Clinical characteristics independently associated with IPT uptake

Table 15: Simple Binary and Multivariable Logistic Regression Analysis

Variables	aOR (95% CI)	P value	cOR (95% CI)	P value
Type of index case				
New case	Ref	Ref	Ref	Ref
Retreatment	1.222 (0.554-2.696)	0.619	6.175 (1.119-34.079)	0.037
HIV status of index case				
Negative	1.639 (0.942-2.870)	0.078	2.718 (0.851-8.675)	0.091
Positive	Ref	Ref	Ref	Ref
Number of AFB seen on Sputum microscopy results				
1-9 AFB/100 fields (1+)	Ref	Ref	Ref	Ref
10-99 AFB/100 fields (2+)	**1.741 (1.056-2.870)**	**0.030**	1.908 (0.677-5.395)	0.223
1-10 AFB/field (3+)	1.329 (0.723-2.444)	0.360	0.999 (0.278-3.592)	0.999
> 10 AFB/field (4+)	**5.313 (2.439-11.570)**	**<0.001**	2.605 (0.484-14.018)	0.265
MDR-TB				
Negative	Ref	Ref	Ref	Ref
Positive	**0.551 (0.226-1.3440**	**0.190**	**0.042 (0.007-0.277)**	**0.001**
TB Suggestive symptom				
Absent	Ref	Ref	Ref	Ref
Present	**1.108 (0.604-2.031)**	**0.741**	**0.233 (0.078-0.700)**	**0.009**
Previous use of ITP				
Has no previous use of IPT	Ref	Ref	Ref	Ref
Has previous use of IPT	0.955 (0.308-2.958)	0.936	1.199 (0.158-9.087)	0.861

aOR: unadjusted odds ratio; cOR: adjusted odd ratios; CI: confidence interval; Ref: reference category HIV: Human immunodeficiency virus; MDR-TB: Multiple drug resistance TB; AFB: Acid fast bacilli;

Table 15 shows the relationship between clinical characteristics and IPT uptake amongst child contacts. On bivariate analysis, sputum microscopy findings was significantly associated with IPT uptake amongst child contacts. On multivariate analysis the association between sputum microscopy findings and IPT uptake was lost. However child contacts of index cases with MDR TB had a 95.8% reduced odds of receiving IPT compared to those without MDR TB [OR=0.042 ; (95% CI: 0.007-0.277); p=0.001] while child contacts with TB symptoms had a

92.2% reduced odds of receiving IPT compared to those without TB symptoms [OR=0.233; (95% CI: 0.078-0.700); p=0.009].

4.7.3 Hospital-based factors independently associated with IPT uptake

Table 16: Simple Binary and Multivariable Logistic Regression Analysis

Variables	aOR (95% CI)	P value	cOR (95% CI)	P value
Index case/health worker relationship				
Bad	Ref	Ref	Ref	Ref
Good	**2.127 (1.056-4.285)**	**0.035**	2.907 (0.670-12.081)	0.861
Contact tracing				
Not traced	Ref	Ref	Ref	Ref
Traced	**11.554 (6.991-19.095)**	**<0.001**	**5.783 (1.458-22.938)**	**0.013**
Contact screening				
Not screened for TB	Ref	Ref	Ref	Ref
Screened for TB	**16.609 (10.117-27.268)**	**<0.001**	**39.308 (9.395-135.973)**	**<0.001**
Free and available TB screening				
No free screening offered	Ref	Ref	Ref	Ref
Free screening offered	**5.778 (3.633-9.190)**	**<0.001**	2.094 (0.623-7.032)	0.232
Type of health facility				
Private	**1.021 (0.612-1.703)**	**0.936**	**0.242 (0.069-0.850)**	**0.027**
Public	Ref	Ref	Ref	Ref
Educated on the benefits of ITP				
Not educated on IPT	Ref	Ref	Ref	Ref
Educated on IPT	**4.028 (2.415-6.718)**	**<0.001**	**3.865 (1.172-12.746)**	**0.026**
Incur screening cost				
Did not pay for screening	Ref	Ref	Ref	Ref
Paid for screening	**2.425 (1.242-4.736)**	**0.010**	0.807 (0.203-3.209)	0.761

aOR: unadjusted odds ratio; cOR: adjusted odd ratios; CI: confidence interval; Ref: reference category IPT: Isoniazid preventive therapy

Table 16 shows the hospital-based characteristics independently associated with IPT uptake amongst child contacts using multivariate analysis. On bivariate analysis, a good index case/health worker relationship, child contact tracing, child contact screening, offering free TB screening services at treatment facility to child contacts , incurring screening cost (paying for test) and being educated on the benefits of ITP during anti-TB treatment were hospital-based factors significantly associated with IPT uptake. After multivariate analysis, child contact tracing, child contact screening, public health facilities and being educated on the benefits of ITP during anti-TB treatment were independently predictive of IPT uptake amongst child contacts.

Child contacts who were traced to their homes were 5.8 times more likely to receive IPT compared to those who were not traced [OR=5.783; (95% CI: 1.458-22.938); p=0.013].

Child contacts who were screened were 39 times more likely to receive IPT compared to those who were not screened [OR=39.308; (95% CI: 9.395-135.973); p<0.001].

Child contacts of index cases who received anti-TB medications in private health facilities had 75.8% reduced odds of receiving IPT compared to those who received anti-TB medications in public health facilities [OR=0.242 ; (95% CI: 0.069-0.850); p=0.027].

Child contacts of index cases who were educated on the need for IPT were 3.9 times more likely to receive IPT compared to those who were not educated [OR=3.865; (95% CI: 1.172-12.746); p=0.026].

4.7.4 Community based factors independently associated with IPT uptake

Table 17: Simple Binary and Multivariable Logistic Regression Analysis

Variables	aOR (95% CI)	P value	cOR (95% CI)	P value
Fear of acquiring TB				
Not afraid child will get TB	Ref	Ref	Ref	Ref
Afraid child will get TB	**3.591 (2.320-5.558)**	**<0.001**	0.994 (0.407-2.426)	0.989
TB related stigma				
Had no TB related stigma	Ref	Ref	Ref	Ref
Had TB related stigma	**3.361 (2.133-5.295)**	**<0.001**	**10.624 (3.188-35.410)**	**<0.001**
Educated on IPT at the community level				
Not educated on IPT during home visit	Ref	Ref	Ref	Ref
Educated on IPT during home visit	1.276 (0.752-2.166)	0.367	0.423 (0.149-1.205)	0.107
Reluctance to receive IPT				
Not reluctant to receive IPT	Ref	Ref	Ref	Ref
Reluctant to receive IPT	**1.331 (0.808-2.194)**	**0.262**	**0.298 (0.092-0.961)**	**0.043**
Accessible for TB cases				
Health facility not accessible	Ref	Ref	Ref	Ref
Health facility accessible	**2.297 (1.403-3.759)**	**0.001**	**4.021 (1.297-12.467)**	**0.016**

aOR: unadjusted odds ratio; cOR: adjusted odd ratios; CI: confidence interval; Ref: reference category; IPT: Isoniazid preventive therapy

On bivariate analysis, being afraid the child will develop TB, experiencing TB related stigma and attending an accessible health facility were community related factors significantly associated with IPT uptake amongst child contacts. After adjusting for confounders, experiencing TB related stigma, reluctance to receive IPT and attending an accessible health facility were seen to be independently associated with IPT uptake.

Child contacts of index cases who experienced TB related stigma were 10.6 times more likely to receive IPT compared to those without stigma [OR=10.624; (95% CI: 3.188-35.410); p<0.001].

Child contacts of index cases who attended easily accessible TB treatment facilities were 4 times more likely to receive IPT compared to those who were far from the hospital [OR=4.021; (95% CI: 1.297-12.467); p=0.016].

Child contacts of index cases who were reluctant to receive IPT had a 70.2% reduced risk of receiving IPT compared to the child contacts of index cases who were not reluctant to receive IPT [OR=0.298; (95% CI: 0.092-0.961); p=0.043].

4.8 QUALITATIVE RESULTS

4.8.1 Background Characteristics of Health Workers

Table 18: Background characteristics of the Health Workers

Variables	Frequency (n)	Percentage (%)
Age groups		
< 40	2	28.6
>40	5	71.4
Gender		
Female	5	71.4
Male	2	28.6
Years of experience		
<5	4	57.1
>5	3	48.9
Duty held at TB treatment facility		
Doctor	2	28.6
Pharmacist	2	28.6
TB nurse	3	48.9
Type of facility		
Private	2	28.6
Public	5	71.4

The purpose of the qualitative research was to obtain in depth knowledge on the perspective of IPT program, facilitators and barriers to its uptake and suggestions to improve on challenges. A total of 7 health workers were interviewed. They were made up of five (71.4%) females, five (71.4%) were aged > 40 years, four (57.1%) had < 5 years working experience at the TB treatment facility and five (71.4%) were from public facilities as shown in the table below.

4.8.2 Facilitators of IPT uptake amongst child contacts

4.8.2.1 Effective and continuous sensitization and counselling programs

Most of the participants reported that sensitizing and counselling of index cases was the main facilitators of INH uptake. The effectiveness of sensitization on IPT benefits was key is helping patients understand the need and importance of enrolling their child contact on IPT.

Firstly when I take time to explain the benefits of IPT to them, it allows them to express their views about the drug so making it easy to convince them to take the drug (Participant 1).

Daily communicating with and educating them on the various preventive methods of TB including the need for IPT…some get to understand and accept to enrol their children (Participant 3).

When the TB patients don't have a good understanding of the problem they will not cooperate, so when such patients are well counselled and they understand what their children are being exposed to then they will accept follow up and bring their children for IPT (Participant 4).

What has been mainly working for us in this unit is communication, daily communication and educating them on the various preventive methods of TB including the use of IPT, some get to understand and accept to enrol the exposed children (Participant 5).

4.8.2.2 Level of knowledge on IPT benefits:

The knowledge on the IPT by some patients also helped to facilitate IPT uptake amongst child contact.

Some patients are also curious and ask what they will do so that their children should not be contaminated as well, some come asking if there was any drug that could be prescribed for those at home and this really facilitates the process of IPT initiation (Participant 6)

The index cases who are educated on the benefits of IPT especially those coming from the HIV treatment centres so when we start to talk about the need for IPT, they easily accept to enrol (Participant 7)

Some educated and enlightened index cases who are initially reluctant to enrol their children finally accept after they must read on the TB prevention (Participant 2).

4.8.2.3 Good index case/health worker relationships

Good service delivery which includes; building a good relationship (being friendly) with index cases, being supportive and providing all the needed information, especially information on the benefits of IPT or length of treatment and follow-up procedures were identified as facilitators of IPT uptake in this study.

Secondly having a good relationship with the TB index cases makes it easier to convince them to accept the IPT because counselling and sensitization on the need for TB prevention using IPT has never been enough and the uptake of IPT depends solely on the client of the TB index case himself so we try our best to inform them so it works for some but not all of them (Participant 1).

I am usually very friendly with all my patients and support them psychologically and this strong relationship I have with them makes them to accept all the necessary preventive measures that we are using. Being friendly with the TB patients really motivates some of them to enrol their children (Participant 5).

This is faith-based institution and we really do focus on issues of stigma and provide counselling at the mental health unit. Putting them first and always giving a listening ear really makes them comfortable with us and it becomes so easy to convince them to enrol their exposed children (Participant 4).

4.8.2.4 Free cost of child contact screening

The availability of free and or affordable contact screening was one of the main factors that promoted the uptake of INH since most the index cases could not incur the cost of screening test such as CXR and Nasogastric tube insertion for sputum sample collection.

The main issue that matters in the communication process, letting them to understand that screening is relatively free though not totally free and at some point we stopped charging patients for the insertion of nasogastric tube and patients only buy the materials that is the tube itself so reducing the financial burden has helped a little bit (Participant 3).

We tried to reduce the cost of screening and then provided available and free services that is right up to the consultation and this helped to increase the coverage of IPT because most patients could not afford the screening test for their child contacts (Participant 2).

I sometimes facilitate the screening process by not including test that are costly, sometimes I will use tuberculin skin test (TST) in place of CXR so that the parents and caregivers can easily afford (Participant 7).

4.8.2.5 Contact tracing

Contact tracing even though often very limited in our study settings also facilitates the uptake of INH. Health workers who constantly stay in touch with their index cases through phone calls also helps to increase the uptake of IPT.

I will say that even though I don't get to visit all my patients, I try to call and talk to them about their drugs and other concerns, and I also remind them to bring their children (Participant 4).

This TB unit has so many TB patients on treatment such that we are unable to visit all of them, so we call them every 2 weeks to do follow up and this calls include the identification of child contacts for screening and IPT initiation (Participant 6).

When I visit them, I identify child contacts that were not included in our contact tracing register and then I ask them to come to the hospital for IPT (Participant 3)

4.8.3 Barriers of IPT uptake amongst child contacts

Although health care providers considered IPT uptake an effective intervention method, they indicated several concerns with IPT uptake that challenged their comfort and satisfaction with the intervention. The absence of or limited contact tracing in most of the facilities, absence of laid down procedures, insufficient and available personnel to assist with contact tracing, high screening cost incurred by index cases and parents of children and stigmatisation amongst index cases made it difficult to identify these child contacts who have been in one way or the other exposed to patients with SPPTB.

4.8.3.1 Low risk perception amongst index cases

Low risk perception amongst index cases is the main barrier of IPT uptake this results in the refusal by index cases to identify and enrol their children.

So after sensitization we really ask them to bring their children and inform them that it is free but some of them just refuse to bring the children and they keep giving several excuses when they come for their own drugs. In my opinion the issue is not the lack of money to pay for the screening test and transportation to bring the exposed children to the hospital. The main barrier is the lack of understanding of the risk of contamination and the benefits of IPT, such that patients who have the money for screening and are learned do not bring their children so if the index case does not understand they will refuse to enrol their children so refusal is the main barrier despite the level of understanding and the repeated counselling (Participant 3).

No matter how much we try to sensitize the patients on the need for IPT to protect their children they bring up several excuses. Some will say the children don't really spend much with them, some will say the children are on holidays or that the children are not living somewhere else (Participant 6).

4.8.3.2 Reluctance to enrol child contacts

Another barrier that was identified was the reluctant attitudes of patients in bring their exposed child for IPT uptake, most patients gave several excuses why they do not bring their exposed children for treatment, and some gave reasons such as; the children are not living in the same house with them or that the children are well.

It is often very difficult to convince patients or parents to bring their exposed children for screening and then for preventive treatment. Certain or some parents say they do not have children at home whiles some accept but are not willing or feel reluctant to bring their children, so that is why for now not all children receive the IPT (Participant 2).

Sometimes the index cases are still reluctant to bring their children for IPT despite all the sensitization we do, so in essence it is the index cases who refuse because they may accept that they have exposed children but they keep giving several reasons why the children could not be brought for screening; some say the children do not really spend time with them so they are not exposed and can never be ill, others say the children are fine they do not have any symptoms so there is no need for prevention, others say the children are on holidays and are no longer with them (Participant 5).

Some index cases are really reluctant to enrol their child contact due to the absence of TB suggestive symptoms and it is often difficult to convince some patients that their children could develop TB later on in life (participants 6)

Some TB patients often say that their children are well and claim that there is no need for IPT in the absence of chronic cough and other symptoms (Participant 4).

Reluctance in some cases is not only because of the absence of TB symptoms but because they of the prolonged INH use and the burden of the drug. Some patients are reluctant they afraid of the side effects the drug can have on their children (Participant 7).

4.8.3.3 Limited child contact tracing

Contact tracing in our setting was not ideal because it was mostly limited to phone calls and not home visited and most participants reported the limited child contact tracing procedures resulted in a lot of unidentified child contacts.

Contact tracing has been a night mare to us because Douala is a large city and at the entry point the patient address is given and recorded in the patients folder but at some point during the treatment the patients the index case relocates to another community and also to get them through phone calls is usually difficult because some of them misplace the numbers registered in their folders and never retrieve but go for different numbers so getting them through phone numbers is difficult sometimes and for some to trace them back to their homes is almost impossible so contact tracing is really a night mare to us, it has not been effective we have tried several times, we could go to the field today, targeting more than 10 home visits but we will not end up even doing up to 5 home visits so it's really a challenge (Participant 4).

Contact tracing is usually not done at all levels in the hospital so at the TB unit we receive TB patients with a confirm diagnosis coming mostly from the doctor's office. The doctors don't start contact tracing at his office and this makes it difficult to initiate effective IPT discussions besides sometimes we even forget because of too much work (Participant 3).

4.8.3.4 Cost incurred for child contact screening

Cost of screening was a major barrier that came up during most of the interview, most health workers agreeably consented to the fact that even though screening from the initial stages was free it was not entirely free as the patients would have to pay for some of the tests and this was a huge challenge to the patients especially if they have child contacts who they have to bring for screening as well. This barrier actually prevented most patients who had exposed child contact to bring them for screening since the children were not experiencing or showing any symptoms.

Another barrier to the uptake of IPT is the cost of screening incurred by the family of the child and the child contacts so at the end of the day they spend money that they do not have so they refuse to bring their children for IPT (Participant 3).

At the moment management and prevention of TB is not totally free, even with the index cases the only free tests are HIV test, gene xpert and sometimes the microscopy but not all the time, sometimes the sputum culture and the chest x-ray are all not free so they refuse to bring their children because they think they will incur the same cost to screen their children as they did during their diagnosis (Participant 4).

4.8.3.5 Stigmatization

Stigmatization was another barrier of IPT implementation identified in this study.

The main barrier is the parent themselves they do not want people in the community to know that they have TB so they deliberately kind of refuse to identify child contacts because they won't be able to bring the children from home since the children may not be theirs, so they would need the consent of the parents and getting the consent of the parent would require that they tell the parents that they have TB and most of them cannot afford to tell these family members or neighbours that their children have been exposed and they are sick and their children would require prevention. In our context TB is an illness that is greatly associated with stigmatization so some index cases refuse to bring the child not because they do not want to or because they do not understand the benefits of isoniazid in TB prevention but because they feel stigmatized and would not let people or their parents to know they are ill and the exposed children who are not theirs tend not to benefit from IPT. Usually our patients say that once they tell the people that they are sick the people start avoiding them so the moment reaches where they have to persuade them to bring children under five who have been in the same environment as them it becomes difficult so that is why some of the children are not receiving IPT. (Participant 3).

So most index cases who are not the parent of the child contacts will tell us that they do not have the courage to tell the parents or the neighbours or the family members of the children have TB through them that they have pulmonary TB and their children would need IPT in order to prevent or avoid active TB in the near future so it has been a challenge because of the level of stigma (Participant 5).

4.8.3.5 Lack of TB health workers

Most of the health workers reported that the lack of TB health workers as a major hindrance to IPT uptake. In this study, each treatment facility had two health workers who are in charge of counselling, contact tracing, screening, providing DOTs and IPT services.

We cannot discuss much about IPT due to lack of sufficient time and high patient load, so patients usually complain about the long waiting time to get the service (Participant 1).

Our patients are so many and we are just two of us here, sometimes we really try but it is easy to be do that every day because some days are very busy (Participant 5).

I am alone in this office and my colleague who is on leave has not been replaced. Even when she is there they workload is too much so at some point we don't focus much on IPT and we focus more on the index cases (Participant 6).

4.8.4 Solutions that could increase IPT uptake

Several solutions mentioned that could help scale up IPT uptake amongst child contacts were through; improved education and sensitization of patients with child contacts on the need for IPT, provision of more health workers, improved child contact tracing and identification, reduction of screening cost and counselling on the issue of stigma due to TB.

4.8.4.1 Improved education and sensitization of patients

At the patient level continuous education and sensitization should be done to convince the index cases about the need for IPT because that is where the patient begins to understand why isoniazid is necessary and it should be something that is systematic and not done for only some patient and some patients go home without any sensitization on the need of IPT. So sensitization and education for IPT should be done at entry level at the hospital, it's very important. (Participant 4)

In order for the patients to abide with what you have as a program you need to give them good counsel, you need to be explicit whatever they are doing is for their own good, understand what you are explaining, they would be able to understand that if they fail to abide all the people that they are in contact with are at risk in their presence so we really need to make sure that from the beginning we counsel them so that they know as far as this treatment is concerned (Participant 4)

Sensitization can never be done only once sometimes the patients refuse to accept IPT during the first counselling and sensitization of the first routine visit but may accept ITP in the second visit so sensitization should never end it is very important to talk and talk and let the patient express their difficulty and concerns regarding the interventions (Participant 2).

4.8.4.2 Provision of more health workers

I think that having more staff in the TB office would be of great necessity, why because the TB unit of this hospital is a very big department…having someone to work for this program alone will be effective…the person will identify each and every index case with child contacts and easily follow them up…I think that is one of the points that we can consider (Participant 5).

Tracing and identifying all contacts is challenging and I think that having more staff members who will act as community health workers can really help to pick up the unidentified children (Participant 6).

4.8.4.3 Improved contact tracing

Contact tracing is usually not done at all levels in the hospital so at the TB unit we receive TB patients with a confirm diagnosis coming mostly from the doctor's office. The doctors are the first to see these patients and ought to start contact tracing and this will help us not to forget because the doctor is the first person who sees this patient and the patient listens to them, then they can start by asking and explaining to them the need for IPT, then it will be easy for us to continue with what he or she may have done in his office (Participant 3).

Like I said contact tracing and identification of all contacts is very important and that it should not be limited to phone calls and reminders but should include as community visits ti help to pick up the unidentified child contacts (Participant 6).

4.8.4.4 Counselling against stigmatization

Counselling against stigmatization was identified as an important tool in the uptake of IPT among child contacts, most health workers emphasized that appropriate and effective counselling goes a long way to bridge the gap in IPT implementation caused by stigma.

Counselling against stigmatization can help index cases who pose difficulty in order to trace their child contacts at home, because TB patients afraid of stigma cannot bring their child contacts for IPT so counselling will go a long way to help patients to understand that in as

much as TB is infectious it is necessary that they overlook the stigmatization and see the need for TB prevention in these children (Participant 3).

4.8.4.5 Provision of free screening services

We always try to minimize the cost of screening but screening is not free at all levels. Sometimes a child with symptoms will require more test that the patients or parents can't afford, so making the screening process free is the best way to solve this problem (Participant 3).

Unlike other treatment centres, we don't have screening services like tuberculin skin test and CXR, so we ask our patient to do these test elsewhere making the process more expensive and challenging for the patient. I think that our facility could have at least CXR machine that will help (Participant 4).

Most patients who are willing to enrol their contacts will easily accept IPT if laid down screening procedures are made available. Consultation by the paediatrician or general practitioner and laboratory tests are the main entry point for most child contacts and therefore should be free to facilitate IPT uptake (Participant 7).

CHAPTER FIVE

DISCUSSION

5.1. DISCUSSION

The primary objective of this study was to assess the uptake of IPT by child contacts and associated factors in order to inform the NTP on its implementation. The main observations in our study were as follows: the proportion of IPT uptake was 23.0% (95% CI: 19.6-26.9). Younger index cases, being the parents of the child contact and sharing the same room with child, child contact tracing, child contact screening, being educated on the benefits of ITP during anti-TB treatment, experiencing TB related stigma and accessibility of health facility were independently associated with IPT uptake.

Details of our findings with respect to our objectives are discussed below as follows:

5.1.1 Prevalence of IPT uptake

WHO recommends that all child contacts of index cases diagnosed with SPPTB should be clinically evaluated for active TB. The two main goals of contact screening and management are: to identify contacts of all ages with undiagnosed TB disease among the contacts of an index case, and to provide preventive therapy for contacts without TB disease who are susceptible to developing disease (WHO, 2015b).

In this present study, 23.0% (95% CI: 19.6-26.9) of child contacts were initiated on IPT. Studies in India (A. R. Singh et al., 2017) and South Africa (Osman et al., 2013) have reported 22% and 26.8% of IPT uptake which is similar to the findings of the current study. Despite the slight differences in the methodology and study designs, the IPT uptake established in this study was found to be higher than 6.3% (Claessens et al., 2002) and 18.0% (Hall et al., 2015) reported in Malawi, Timor-Leste. In this current study only 24.8% (95% CI: 21.2-28.7%) of child contacts were screened hence the low coverage of child contact screening observed in this study could account for this low level of IPT uptake. However, the proportion of child contacts screening in this present study is lower than that found in two previous studies in South

Africa who reported 42% (Osman et al., 2013) and 72% (Black et al., 2018) of child contact screening. Hence the opportunity to screen child contacts was missed in majority of child contacts identified. This could relate to the problem of passive case finding. Inadequate and incomplete recording and suboptimal identification of child contacts could also account for low IPT uptake in our study. Majority of the child contacts did not receive IPT because their index cases were never informed about the benefits and availability of IPT. This poor child contact management (CCM) consequently results in failure to identify index cases with child contacts at entry level.

In contrast, several epidemiological studies in South India, Ethiopia, Gambia, Rwanda and Benin have reported 33% (Shivaramakrishna et al., 2014), 64.3% (Tadesse et al., 2016), 89% (Egere et al., 2016), 89% (Birungi et al., 2018) and 99% (Adjobimey et al., 2016) respectively of IPT uptake, which are much higher compared to the findings of the current study. The integration of IPT into the programmatic delivery of healthcare might explain the high uptake reported in the study findings reported in countries such as Gambia, Rwanda and Benin. Unlike Cameroon, Rwanda's NTP strategy adopts the households' visit of index cases by healthcare providers at the beginning of TB treatment and these visits allows for child contacts to be screened and initiated on IPT (Birungi et al., 2018).

5.1.2 Factors associated with IPT uptake

5.1.2.1 Background factors associated with IPT uptake

In multivariate analysis, our results provided evidence that child contacts who were children of index cases were more likely to be initiated on IPT than those who were not their children. This results are in accordance to studies conducted in Timor-Leste (Hall et al., 2015), Rwanda (Birungi et al., 2018) as well as a qualitative study in Bangkok, Thailand (Tornee et al., 2005). These studies reported lack of screening of child contacts who were not children of index cases.

The household structure in Douala, the biggest city in Cameroon contributes to large numbers of child contacts; more often than not, the index case is not the child contact's parent. Often, healthcare providers inform the index cases about the intended child contact screening and initiation on IPT but the index cases may not inform the parents or caregivers of their child contacts the need for initiating their children on IPT. This provides multiple opportunities for the message regarding the need for contact screening to be lost because the index case may choose not to pass on the information to the key caregiver for multiple reasons including stigmatization.

Index case aged 21-40 years of the index cases identified significantly higher proportion who received IPT in this study. To the best of our knowledge, no study has established any relationship between age of index case and IPT uptake amongst child contacts.

This finding indicates that child contacts of younger index cases were more likely to receive IPT than the child contacts of older (>40 year) index cases. Younger index cases were more likely to be the parents of the exposed children and being the parent of child contact was associated with higher IPT uptake.

In this study, child sharing the same room with index case was independently associated with IPT uptake. However, no study has reported any significant association between IPT uptake and sharing the same room with child. Several studies have showed that the risk of developing TB in children is increased with the geographic proximity of the child and with the degree of activities shared with the TB index case such as sleeping in the same room (Døllner, Ramm, Harstad, Afset, & Sagvik, 2012; M. Karim, Rahman, Mamun, Alam, & Akhter, 2012; Triasih, Robertson, Duke, & Graham, 2015; Zafar, 2014). This may be due to the fact that children < 5 years still sleep in the same room with their parents/caregivers who had SPPTB. The low socioeconomic status, limited basic housing, large household density and the presence of

overcrowding within the communities in Douala encourages the sharing of rooms and sleeping space between adults and children.

5.1.2.2. Clinical factors associated with IPT uptake

Child contacts presenting with TB suggestive symptoms at screening were less likely to receive IPT. Very few child contacts presented with symptoms suggestive of TB (12.7%) in this study but no association was seen between having TB symptoms and screening for TB (p=0.131). IPT uptake may be lower among child contacts with symptoms because the presence of TB symptoms warranted more screening and laboratory investigation to rule out active TB.

Having MDR TB was independently associated with reduced IPT uptake. Furthermore, Very few index cases reported to have been diagnosed with MDR TB (8.0%) in this study**.** MDR TB is resistant to at least rifampin and isoniazid many clinicians are uncomfortable treating a child exposed to an MDR organism with isoniazid (Seddon et al., 2013). Hence the reason why child contacts of index cases with MDR TB had a reduced uptake rates in this study.

5.1.2.3 Hospital based factors associated with IPT uptake

Our results showed that contact tracing and screening was independently predictive of IPT uptake. Contrarily, a cross-sectional descriptive study which included 246 child contacts in a busy primary healthcare Clinic in South Africa showed that child contacts of male patients and retreatment index patients were less likely to be screened and those who were screened were less likely to initiate IPT(Black et al., 2018). This is because the ‘no test’ screening was used where IPT was offered to majority of child contacts who were not screened for active TB. The ‘no test’ screening method has been shown to be the most cost effective technique in young children exposed to TB (Mandalakas et al., 2013). The main reason why screened child contacts in our study were more likely to receive IPT was because screening before IPT initiation was mandatory in the selected treatment facilities. Furthermore, inadequate documentation in

patient folders made it impossible to determine whether the index cases and or caregivers of the child contacts were offered IPT and declined, or whether IPT was prescribed or not.

Even though child contact tracing was significantly associated with uptake in this study, only 37.8% of child contacts were traced back to their homes and 24.8% of child contact screened for TB. These findings are similar to several studies which have also reported poor child contact documentation and identification (Black et al., 2018; Osman et al., 2013; Shivaramakrishna et al., 2014). Therefore child contact tracing and screening represent an important entry point for IPT uptake amongst child contacts.

Our study established that child contacts in private health institutions were less likely to receive IPT than those in the public health facilities. To the best of our knowledge no epidemiology has showed any relationship between type of health facility and IPT uptake amongst child contacts. However the fact that very few private health facilities were included in this study could account for this difference. Private health facilities are more expensive and are usually not fully engaged in disease control and prevention activities compared to government owned health facilities. According to WHO, engaging all relevant health care providers in TB care and control through public-private mix (PPM) approaches is an essential component of the End TB Strategy (WHO, 2018c).

Our study showed that 60.0% of parents/caregivers of child contacts were educated on how to prevent TB in children and the child contacts of parents/caregivers who were educated were more likely to receive IPT. Contrarily, a study conducted in Rwanda showed only 32% had knowledge of IPT prevention and parents/caregivers' lack of information on the need for IPT was one of the reasons for not initiating IPT (Birungi et al., 2018). Educating TB index cases on the benefit and need for IPT forms the basis of IPT uptake. Health workers at healthcare facilities educate these parents/index cases at the initial phase of TB treatment and community

health workers at the community level also educated patients during home visits for contact tracing.

5.1.2.4 Community-based factors associated with IPT uptake

Our study also established that child contacts of index cases experiencing TB related stigma was were more likely to receive IPT and the fear of acquiring TB was associated with IPT uptake on bivariate analysis but this association was lost on multivariate analysis. This is however different from other qualitative studies which have reported that fear of stigma and discrimination occur a lot when TB status of the index case is disclosed especially amongst index cases living with HIV (Omesa et al., 2016). Hence fear of acquiring TB and stigmatization could explain why index cases can be prompted to bring their child contacts for screening and IPT initiation.

Accessibility of health facility was an independent predictor of IPT uptake amongst child contacts in this study. This indicates that peripheral health facilities can effectively implement IPT and that IPT can be decentralized in order to make it more accessible to other communities.

A follow-up qualitative study to understand the key factors from health worker perspectives that favorably influenced the IPT uptake amongst child contacts revealed that the level of knowledge about IPT benefits, effective & continuous sensitization sessions, good index case-health worker relationships, free screening of child contacts and contact screening were the main facilitators of IPT uptake. Effective sensitization and counselling programs for patients with child contacts were key tools that influenced IPT uptake. Information about the benefits and effects of IPT was reported to be even though limited among the patients facilitated the IPT uptake. However due to the level of knowledge on the benefits of IPT for exposed child contacts, misconceptions about IPT among the patients may have caused some patients to refuse to bring their child contacts to be enrolled even after being counselled.

The uptake of IPT was facing a challenge in resource limited settings and the following barriers were responsible for the suboptimal implementation of IPT: low risk perception amongst index cases, reluctance to enroll child contacts for IPT in the absence of TB symptoms, limited child contact tracing, cost incurred for child contact screening and stigmatization. These findings actually reflect similar issues identified amongst index cases and their child contacts. However improved education and sensitization of index cases, provision of more health workers, improved contact tracing, counselling against stigmatization and provision of free screening services were solutions necessary to scale up the uptake of IPT in this study.

5.1.3 Study limitations and strength

Firstly, the research was conducted in Douala; thus the findings might not be generalized to the whole country, especially in remote rural areas where varying healthcare-seeking behavior exist. A major limitation of this study is that information on child contact tracing, screening for TB disease and IPT initiation was ascertained through a questionnaire administered to care givers of household contacts. If there were any deficiencies in information recall or in understanding the questions, then the results may be biased. To address this possibility, we also reviewed the information recorded in the patients' records to cross-verify the consistency of information in order to minimize the magnitude of errors as a result of deficiencies in recall.

Our study had several strengths. Firstly, we used mixed-method study design, which helped us to quantify the magnitude of the problem and provided insights into the reasons for the problem, thus providing holistic overview. Secondly, we conducted the study in programmatic settings of Douala the biggest City in Cameroon, thus reflects the realities on the ground. Thirdly we included 9 selected healthcare facilities from slightly different geographical areas, with varying TB case-loads and programme conditions. Hence this was representative of all primary health care facilities in the city of Douala.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

This study shows that NTP recommendations for screening and prevention of TB amongst child contacts was not being followed in Douala and IPT implementation was poor. Few child contacts of index cases are screened for active TB and even fewer are offered IPT. Poor IPT uptake represents a missed opportunity to prevent future TB cases amongst the exposed children. This is consistent with earlier studies conducted in other parts of Africa and other low and middle income countries (LMICs). Major gaps in IPT uptake may be scaled up by training of health workers, improved logistics and enhanced supervision and monitoring. Protecting the next generation against TB is a task that responsible TB control programmes should not ignore (Donald, 1999). Hence these shortcomings need to be discussed at management meetings and training sessions within the NTP. NTP staff need to be better briefed on the importance of childhood screening, and quarterly supervisory visits must include some routine measurement of how well childhood contact screening is implemented at district level.

6.2 RECOMMENDATIONS

6.2.1 To the National TB programme (NTP)

We recommend that the NTP should:

- Train healthcare providers on the benefits and implementation of IPT
- Provide more health workers who will assist in contact identification and tracing
- Simplify screening procedures and provide free screening services to all child contacts
- Consider community based IPT delivery as an option to scale up IPT uptake
- Introduce an indicator to strengthen monitoring of IPT uptake
- Motivate health workers and health facilities involved in the provision of IPT services

6.3.2 To the Healthcare provider

We recommend that the health providers should:

- Systematically educate and inform index cases with child contacts on the benefits of and need for IPT at each hospital visit
- Systematically identify and document index cases with child contacts
- Consider contact tracing as the best option to pick unidentified child contacts
- Routinely counsel parents on TB related stigma
- Maintaining good index case/health worker relationships

6.3.3 To the TB index cases

We recommend that the TB index cases should

- Comply with health worker to identify all possible child contacts
- Enroll their child contacts for screening and IPT provided at the TB treatment facilities

REFERENCES

Adjobimey, M., Masserey, E., Adjonou, C., Gbénagnon, G., Schwoebel, V., Anagonou, S., & Zellweger, J.-P. (2016). Implementation of isoniazid preventive therapy in children aged under 5 years exposed to tuberculosis in Benin. *The International Journal of Tuberculosis and Lung Disease*, *20*(8), 1055–1059. https://doi.org/10.5588/ijtld.15.0493

Ahmed, T., Sobhan, F., Ahmed, A. M. S., Banu, S., Mahmood, A. M., & Hyder, K. A. (2008). Childhood tuberculosis: A review of epidemiology, diagnosis and management. *Infect Dis J*, *17*(2), 52–60. Retrieved from Scopus.

Andersen, P., Munk, M. E., Pollock, J. M., & Doherty, T. M. (2000). Specific immune-based diagnosis of tuberculosis. *Lancet (London, England)*, *356*(9235), 1099–1104.

Attah, C. J., Oguche, S., Egah, D., Ishaya, T. N., Banwat, M., & Adgidzi, A. G. (2018). Risk factors associated with paediatric tuberculosis in an endemic setting. *Alexandria Journal of Medicine*, *54*(4), 403–409. https://doi.org/10.1016/j.ajme.2018.05.002

Ayieko, J., Abuogi, L., Simchowitz, B., Bukusi, E. A., Smith, A. H., & Reingold, A. (2014). Efficacy of isoniazid prophylactic therapy in prevention of tuberculosis in children: A meta–analysis. *BMC Infectious Diseases*, *14*(1). https://doi.org/10.1186/1471-2334-14-91

Bates, M., O'Grady, J., Maeurer, M., Tembo, J., Chilukutu, L., Chabala, C., … Zumla, A. (2013). Assessment of the Xpert MTB/RIF assay for diagnosis of tuberculosis with gastric lavage aspirates in children in sub-Saharan Africa: A prospective descriptive study. *The Lancet. Infectious Diseases*, *13*(1), 36–42. https://doi.org/10.1016/S1473-3099(12)70245-1

Birungi, F. M., Graham, S., Uwimana, J., & van Wyk, B. (2018). Assessment of the Isoniazid Preventive Therapy Uptake and Associated Characteristics: A Cross-Sectional Study. *Tuberculosis Research and Treatment*, *2018*, 1–9. https://doi.org/10.1155/2018/8690714

Black, F., Amien, F., & Shea, J. (2018). An assessment of the isoniazid preventive therapy programme for children in a busy primary healthcare clinic in Nelson Mandela Bay Health District, Eastern Cape Province, South Africa. *South African Medical Journal*, *108*(3), 217. https://doi.org/10.7196/SAMJ.2018.v108i3.12639

Centers for Disease Control and Prevention (CDC). (1993). Estimates of future global tuberculosis morbidity and mortality. *MMWR. Morbidity and Mortality Weekly Report*, *42*(49), 961–964.

Claessens, N. J. M., Gausi, F. F., Meijnen, S., Weismuller, M. M., Salaniponi, F. M., & Harries, A. D. (2002). *Screening childhood contacts of patients with smear-positive pulmonary tuberculosis in Malawi*. *6*(4), 362–364.

Comstock, G. W., Livesay, V. T., & Woolpert, S. F. (1974). The prognosis of a positive tuberculin reaction in childhood and adolescence. *American Journal of Epidemiology*, *99*(2), 131–138.

Daniel, O. J., Adejumo, O. A., Gidado, M., Abdur-Razzaq, H. A., & Jaiyesimi, E. O. (2015). HIV-TB co-infection in children: Associated factors and access to HIV services in Lagos, Nigeria. *Public Health Action*, *5*(3), 165–169. https://doi.org/10.5588/pha.15.0027

Dn, B., O, M., R, M., Em, T., Gw, K., Am, M., … On, L. (2017). Risk Factors Affecting Mortality in Children with Pulmonary Tuberculosis in Lubumbashi, Democratic Republic of the Congo. *Journal of Lung, Pulmonary & Respiratory Research*, *4*(6), 1–0. https://doi.org/10.15406/jlprr.2017.4.00151

Døllner, H., Ramm, C. T., Harstad, I., Afset, J. E., & Sagvik, E. (2012). Risk of developing tuberculosis after brief exposure in Norwegian children: Results of a contact investigation. *BMJ Open*, *2*(6), e001816. https://doi.org/10.1136/bmjopen-2012-001816

Donald, P. R. (1999). Children and tuberculosis: Protecting the next generation? *Lancet (London, England)*, *353*(9157), 1001–1002. https://doi.org/10.1016/s0140-6736(99)02010-3

Eamranond, P., & Jaramillo, E. (2001). Tuberculosis in children: Reassessing the need for improved diagnosis in global control strategies. *The International Journal of Tuberculosis and Lung Disease: The Official Journal of the International Union Against Tuberculosis and Lung Disease*, *5*(7), 594–603.

Egere, U., Sillah, A., Togun, T., Kandeh, S., Cole, F., Jallow, A., … Kampmann, B. (2016). Isoniazid preventive treatment among child contacts of adults with smear-positive tuberculosis in The Gambia. *Public Health Action*, *6*(4), 226–231. https://doi.org/10.5588/pha.16.0073

Garie KT, Yassin MA, & Cuevas LE. (2011). *Lack of adherence to isoniazid chemoprophylaxis in children in contact with adults with tuberculosis in southern Ethiopia*. *6*(11), e26452. https://doi.org/10.1371/ journal.pone.0026452

Gebremichael, B., Abebaw, T.-A., Moges, T., Abaerei, A. A., & Worede, N. (2018). Predictors of pediatric tuberculosis in public health facilities of Bale zone, Oromia region, Ethiopia: A case control study. *BMC Infectious Diseases*, *18*. https://doi.org/10.1186/s12879-018-3163-0

Graham, S. M., Ahmed, T., Amanullah, F., Browning, R., Cardenas, V., Casenghi, M., … Wingfield, C. (2012). Evaluation of tuberculosis diagnostics in children: Proposed clinical case definitions for classification of intrathoracic tuberculosis disease. Consensus from an expert panel. *The Journal of Infectious Diseases*, *205 Suppl 2*, S199-208. https://doi.org/10.1093/infdis/jis008

Gunda, D. W., Maganga, S. C., Nkandala, I., Kilonzo, S. B., Mpondo, B. C., Shao, E. R., & Kalluvya, S. E. (2018). Prevalence and Risk Factors of Active TB among Adult HIV Patients Receiving ART in Northwestern Tanzania: A Retrospective Cohort Study [Research article]. https://doi.org/10.1155/2018/1346104

Hall, C., Sukijthamapan, P., dos Santos, R., Nourse, C., Murphy, D., Gibbons, M., & Francis, J. R. (2015). Challenges to delivery of isoniazid preventive therapy in a cohort of children exposed to tuberculosis in Timor-Leste. *Tropical Medicine & International Health*, *20*(6), 730–736. https://doi.org/10.1111/tmi.12479

Hesseling, A. C., Cotton, M. F., Jennings, T., Whitelaw, A., Johnson, L. F., Eley, B., … Schaaf, H. S. (2009). High incidence of tuberculosis among HIV-infected infants: Evidence from a South African population-based study highlights the need for improved tuberculosis control strategies. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, *48*(1), 108–114. https://doi.org/10.1086/595012

Hill, P. C., Rutherford, M. E., Audas, R., van Crevel, R., & Graham, S. M. (2011). Closing the Policy-Practice Gap in the Management of Child Contacts of Tuberculosis Cases in Developing Countries. *PLoS Medicine*, *8*(10), e1001105. https://doi.org/10.1371/journal.pmed.1001105

Jafri, R., Malik, A. A., Hussain, H., Hussain, S., Khatoon, F., Asif, K., & Amanullah, F. (2015). IPT uptake among child contacts of TB patients: Experience from the Indus Hospital TB program, Karachi, Pakistan. *International Journal of Mycobacteriology*, *4*, 104–105. https://doi.org/10.1016/j.ijmyco.2014.11.029

Jurcev-Savicevic, A., Mulic, R., Ban, B., Kozul, K., Bacun-Ivcek, L., Valic, J., … Simunovic, A. (2013). Risk factors for pulmonary tuberculosis in Croatia: A matched case–control study. *BMC Public Health*, *13*, 991. https://doi.org/10.1186/1471-2458-13-991

Karim, M. R., Rahman, M. A., Mamun, S. A., Alam, M. A., & Akhter, S. (2012). Risk factors of childhood tuberculosis: A case control study from rural Bangladesh. *WHO South-East Asia Journal of Public Health*, *1*(1), 76. https://doi.org/10.4103/2224-3151.206917

Karim, M., Rahman, M., Mamun, S., Alam, M., & Akhter, S. (2012). What cannot be measured cannot be done; risk factors for childhood tuberculosis: A case control study. *Bangladesh Medical Research Council Bulletin*, *38*(1), 27–32. https://doi.org/10.3329/bmrcb.v38i1.10449

Karumbi, J., & Garner, P. (2015). Directly observed therapy for treating tuberculosis. *The Cochrane Database of Systematic Reviews*, (5), 1. https://doi.org/10.1002/14651858.CD003343.pub4

Kirenga, B. J., Ssengooba, W., Muwonge, C., Nakiyingi, L., Kyaligonza, S., Kasozi, S., … Okwera, A. (2015). Tuberculosis risk factors among tuberculosis patients in Kampala, Uganda: Implications for tuberculosis control. *BMC Public Health*, *15*. https://doi.org/10.1186/s12889-015-1376-3

LIU, E., MAKUBI, A., DRAIN, P., SPIEGELMAN, D., SANDO, D., LI, N., … FAWZI, W. W. (2015). Tuberculosis incidence rate and risk factors among HIV-infected adults with access to antiretroviral therapy in Tanzania. *AIDS (London, England)*, *29*(11), 1391–1399. https://doi.org/10.1097/QAD.0000000000000705

Mandalakas, A. M., Hesseling, A. C., Gie, R. P., Schaaf, H. S., Marais, B. J., & Sinanovic, E. (2013). Modelling the cost-effectiveness of strategies to prevent tuberculosis in child contacts in a high-burden setting. *Thorax*, *68*(3), 247–255. https://doi.org/10.1136/thoraxjnl-2011-200933

Marais, B. J., Gie, R. P., Schaaf, H. S., Hesseling, A. C., Obihara, C. C., Nelson, L. J., … Beyers, N. (2004). The clinical epidemiology of childhood pulmonary tuberculosis: A critical review of literature from the pre-chemotherapy era. *The International Journal of Tuberculosis and Lung Disease: The Official Journal of the International Union Against Tuberculosis and Lung Disease*, *8*(3), 278–285.

Marais, B. J., Gie, R. P., Schaaf, H. S., Hesseling, A. C., Obihara, C. C., Starke, J. J., … Beyers, N. (2004). *The natural history of childhood intra-thoracic tuberculosis: A critical review of literature from the pre-chemotherapy era*. *8*(4), 392–402.

Nelson, L. J., & Wells, C. D. (2004). Global epidemiology of childhood tuberculosis. *The International Journal of Tuberculosis and Lung Disease: The Official Journal of the International Union Against Tuberculosis and Lung Disease*, *8*(5), 636–647.

Newton, S. M., Brent, A. J., Anderson, S., Whittaker, E., & Kampmann, B. (2008). Paediatric tuberculosis. *The Lancet Infectious Diseases*, *8*(8), 498–510. https://doi.org/10.1016/S1473-3099(08)70182-8

Nicol, M. P., Workman, L., Isaacs, W., Munro, J., Black, F., Eley, B., … Zar, H. J. (2011). Accuracy of the Xpert MTB/RIF test for the diagnosis of pulmonary tuberculosis in children admitted to hospital in Cape Town, South Africa: A descriptive study. *The Lancet. Infectious Diseases*, *11*(11), 819–824. https://doi.org/10.1016/S1473-3099(11)70167-0

Noeske, J., Nana Yakam, A., & Abena Foe, J.-L. (2016). Epidemiology of tuberculosis in Cameroon as mirrored in notification data, 2006-2014. *The International Journal of Tuberculosis and Lung Disease:*

The Official Journal of the International Union Against Tuberculosis and Lung Disease, *20*(11), 1489–1494. https://doi.org/10.5588/ijtld.16.0252

Nyirenda, M., Sinfield, R., Haves, S., Molyneux, E. M., & Graham, S. M. (2006). *Poor attendance at a child TB contact clinic in Malawi*. *10*(5), 585–587.

Omesa, E. N., Kathure, I. A., Masini, E., Mulwa, R., Maritim, A., Owiti, P. O., … Galgalo, T. (2016). UPTAKE OF ISONIAZID PREVENTIVE THERAPY AND ITS ASSOCIATED FACTORS AMONG HIV POSITIVE PATIENTS IN AN URBAN HEALTH CENTRE, KENYA. *East African Medical Journal*, 8.

Osman, M., Hesseling, A. C., Beyers, N., Enarson, D. A., Rusen, I. D., Lombard, C., & van Wyk, S. S. (2013). Routine programmatic delivery of isoniazid preventive therapy to children in Cape Town, South Africa. *Public Health Action*, *3*(3), 199–203. https://doi.org/10.5588/pha.13.0034

Rachow, A., Clowes, P., Saathoff, E., Mtafya, B., Michael, E., Ntinginya, E. N., … Hoelscher, M. (2012). Increased and expedited case detection by Xpert MTB/RIF assay in childhood tuberculosis: A prospective cohort study. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, *54*(10), 1388–1396. https://doi.org/10.1093/cid/cis190

Raviglione, M. C., Snider, D. E., & Kochi, A. (1995). Global epidemiology of tuberculosis. Morbidity and mortality of a worldwide epidemic. *JAMA*, *273*(3), 220–226.

Rutherford, M. E., Hill, P. C., Triasih, R., Sinfield, R., van Crevel, R., & Graham, S. M. (2012). Preventive therapy in children exposed to Mycobacterium tuberculosis: Problems and solutions: TB preventive therapy in exposed children. *Tropical Medicine & International Health*, *17*(10), 1264–1273. https://doi.org/10.1111/j.1365-3156.2012.03053.x

Seddon, J. A., Hesseling, A. C., Finlayson, H., Fielding, K., Cox, H., Hughes, J., … Schaaf, H. S. (2013). Preventive Therapy for Child Contacts of Multidrug-Resistant Tuberculosis: A Prospective Cohort Study. *Clinical Infectious Diseases*, *57*(12), 1676–1684. https://doi.org/10.1093/cid/cit655

Seddon, J. A., & Shingadia, D. (2014, June 18). Epidemiology and disease burden of tuberculosis in children: A global perspective. https://doi.org/10.2147/IDR.S45090

Sekadde, M. P., Wobudeya, E., Joloba, M. L., Ssengooba, W., Kisembo, H., Bakeera-Kitaka, S., & Musoke, P. (2013). Evaluation of the Xpert MTB/RIF test for the diagnosis of childhood pulmonary tuberculosis in Uganda: A cross-sectional diagnostic study. *BMC Infectious Diseases*, *13*, 133. https://doi.org/10.1186/1471-2334-13-133

Shivaramakrishna, H. R., Frederick, A., Shazia, A., Murali, L., Satyanarayana, S., Nair, S. A., … Moonan, P. K. (2014). Isoniazid preventive treatment in children in two districts of South India: Does practice follow policy? *The International Journal of Tuberculosis and Lung Disease*, *18*(8), 919–924. https://doi.org/10.5588/ijtld.14.0072

Singh, A. R., Kharate, A., Bhat, P., Kokane, A. M., Bali, S., Sahu, S., … Kumar, A. M. (2017). Isoniazid Preventive Therapy among Children Living with Tuberculosis Patients: Is It Working? A Mixed-Method Study from Bhopal, India. *Journal of Tropical Pediatrics*, *63*(4), 274–285. https://doi.org/10.1093/tropej/fmw086

Singh, M., Mynak, M. L., Kumar, L., Mathew, J. L., & Jindal, S. K. (2005). Prevalence and risk factors for transmission of infection among children in household contact with adults having pulmonary tuberculosis. *Archives of Disease in Childhood*, *90*(6), 624–628. https://doi.org/10.1136/adc.2003.044255

Starke, J. R. (1993). Childhood tuberculosis. A diagnostic dilemma. *Chest*, *104*(2), 329–330.

Starke, Jeffrey R. (2003). Pediatric tuberculosis: Time for a new approach. *Tuberculosis (Edinburgh, Scotland)*, *83*(1–3), 208–212.

Swaminathan, S., & Rekha, B. (2010). Pediatric Tuberculosis: Global Overview and Challenges. *Clinical Infectious Diseases*, *50*(Supplement_3), S184–S194. https://doi.org/10.1086/651490

Tadesse, Y., Gebre, N., Daba, S., Gashu, Z., Habte, D., Hiruy, N., … G. Suarez, P. (2016). Uptake of Isoniazid Preventive Therapy among Under-Five Children: TB Contact Investigation as an Entry Point. *PLOS ONE*, *11*(5), e0155525. https://doi.org/10.1371/journal.pone.0155525

Tesema, C., Tadesse, T., Gebrehiwot, M., Tsegaw, A., & Weldegebreal, F. (2015). Environmental and host-related determinants of tuberculosis in Metema district, north-west Ethiopia. *Drug, Healthcare and Patient Safety*, *7*, 87–95. https://doi.org/10.2147/DHPS.S82070

Tornee, S., Kaewkungwal, J., Fungladda, W., Silachamroon, U., Akarasewi, P., & Sunakorn, P. (2005). Factors associated with the household contact screening adherence of tuberculosis patients. *The Southeast Asian Journal of Tropical Medicine and Public Health*, *36*(2), 331–340.

Triasih, R., Robertson, C., Duke, T., & Graham, S. M. (2015). Risk of infection and disease with Mycobacterium tuberculosis among children identified through prospective community-based contact screening in Indonesia. *Tropical Medicine & International Health*, *20*(6), 737–743. https://doi.org/10.1111/tmi.12484

Tsai, K.-S., Chang, H.-L., Chien, S.-T., Chen, K.-L., Chen, K.-H., Mai, M.-H., & Chen, K.-T. (2013). Childhood Tuberculosis: Epidemiology, Diagnosis, Treatment, and Vaccination. *Pediatrics & Neonatology*, *54*(5), 295–302. https://doi.org/10.1016/j.pedneo.2013.01.019

Van Zwanenberg, D. (1960). The influence of the number of bacilli on the development of tuberculous disease in children. *The American Review of Respiratory Disease*, *82*, 31–44. https://doi.org/10.1164/arrd.1960.82.1.31

Venturini, E., Turkova, A., Chiappini, E., Galli, L., de Martino, M., & Thorne, C. (2014). Tuberculosis and HIV co-infection in children. *BMC Infectious Diseases*, *14*(Suppl 1), S5. https://doi.org/10.1186/1471-2334-14-S1-S5

WHO. (2008). *Isoniazid preventive therapy*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK310749/

WHO. (2015a). *Global Tuberculose Report: 2015*. Genève (Suisse): Word Health Organization.

WHO. (2015b). *Guidance for national tuberculosis programmes on the management of tuberculosis in children.* Geneva: World Health Organization.

WHO. (2016). *World Health Organization. The WHO End TB Strategy*. Retrieved from http://www.who.int/tb/post2015_strategy/en/.

WHO. (2017a). *Cameroon Tuberculosis Profile*. Retrieved from www.who.int/tb/data

WHO. (2017b). *Global Tuberculosis Report: 2017*.

WHO. (2018a). *Global tuberculosis report: 2018*. Geneva, Switzerland: Word Health Organization.

WHO. (2018b). WHO | Global tuberculosis report 2018. Retrieved November 17, 2018, from WHO website: http://www.who.int/tb/publications/global_report/en/

WHO. (2018c). WHO | Public–private mix for TB prevention and care: A roadmap. Retrieved July 15, 2019, from WHO website: http://www.who.int/tb/publications/2018/PPMRoadmap/en/

WHO. (2018d, September). World Health Organization Fact Sheet; Tuberculosis. Geneva: Retrieved November 17, 2018, from World Health Organization website: http://www.who.int/news-room/fact-sheets/detail/tuberculosis

World Health Organization. (2014). *Global Tuberculosis Report 2014:* Retrieved from http://www.myilibrary.com?id=1003372

Zafar, M. (2014). Prevelence of latent tuberculosis and associated risk factors in children under 5 years of age in Karachi, Pakistan. *The Journal of Association of Chest Physicians*, *2*(1), 16. https://doi.org/10.4103/2320-8775.126504

Zar, H. J., Connell, T. G., & Nicol, M. (2010). Diagnosis of pulmonary tuberculosis in children: New advances. *Expert Review of Anti-Infective Therapy*, *8*(3), 277–288. https://doi.org/10.1586/eri.10.9

Zar, H. J., Cotton, M. F., Strauss, S., Karpakis, J., Hussey, G., Schaaf, H. S., … Lombard, C. J. (2007). Effect of isoniazid prophylaxis on mortality and incidence of tuberculosis in children with HIV: Randomised controlled trial. *BMJ*, *334*(7585), 136. https://doi.org/10.1136/bmj.39000.486400.55

Zar, H. J., Hanslo, D., Apolles, P., Swingler, G., & Hussey, G. (2005). Induced sputum versus gastric lavage for microbiological confirmation of pulmonary tuberculosis in infants and young children: A prospective study. *Lancet (London, England)*, *365*(9454), 130–134. https://doi.org/10.1016/S0140-6736(05)17702-2

Zar, H. J., Workman, L., Isaacs, W., Munro, J., Black, F., Eley, B., … Nicol, M. P. (2012). Rapid molecular diagnosis of pulmonary tuberculosis in children using nasopharyngeal specimens. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, *55*(8), 1088–1095. https://doi.org/10.1093/cid/cis598

Zar, H. J., Workman, L. J., Little, F., & Nicol, M. P. (2015). Diagnosis of Pulmonary Tuberculosis in Children: Assessment of the 2012 National Institutes of Health Expert Consensus Criteria. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, *61*(Suppl 3), S173–S178. https://doi.org/10.1093/cid/civ622

APPENDICES

Appendix 1: Data Collection Form

Treatment centre……..	Date of inclusion: |__|__|/|__|__|/|__|__|
File Number……...	DD / MM / YY
Patients contact…….	Date IPT was started: |__|__|/|__|__|/|__|__|
Guardian's contact……...	DD / MM / YY

0 SECTION 0: VERIFICATION OF INCLUSION AND EXCLUSION CRITERIA		
001	Sputum smear microscopy results? 0=Negative; 1=Positive	|__|
002	Complete medical file? 0=No; 1=Yes	|__|
003	Were (Are) there any children under 5 years living in the same house with TB index patients within the period of TB diagnosis? 0=No; 1=Yes	|__|
004	Was the child born after the smear positive TB was diagnosed and initiated on TB treatment? 0=No; 1=Yes; 2=NA	|__|
005	Was the child on TB treatment after screening confirmed active TB? 0=No; 1=Yes; 2=NA	|__|
006	Was the child contacts infected with HIV? 0=No; 1=Yes; 2=NA	|__|
1 SECTION 1: Background of the child contacts		
A. Sociodemographic data of child and TB case		
101	Date of birth of child at diagnosis: |__|__|/|__|__|/|__|__||__|__| (DD/MM/YYYY)	|__|
102	Sex of child: 0=Female; 1=Male	|__|
103	Was (is) the child contact in school? 0=No 1=Yes	|__|
B. Sociodemographic data of TB case		
101	Date of birth of TB case at diagnosis? |__|__|/|__|__|/|__|__||__|__| (DD/MM/YYYY)	|__|
102	Sex of TB case: 0=Female; 1=Male	|__|
103	Do you have a job? 0=No; 1=Yes	|__|
104	What is the monthly income of the household in Francs CFA?	|__ __ __ __|
105	Marital Status. 1=married; 2=single; 3=Widowed; 4=divorced	|__|
106	Religion 1=Christian; 2=Non-Christian	|__|
108	Area of Residence 1=Urban; 2=Rural	|__|
109	Highest level of education attended by TB case? 1=none; 2=primary school; 3=Secondary school; 4=High school; 5=University	|__|

C. Household related factors		
101	Did contact live in the same bedroom with TB case? 0=No; 1=Yes	|__|
102	How many people lived in the same house with the TB case at time of diagnosis (household density at diagnosis)?	|__|
103	What is the average time spent per day with contact before diagnosis?	|__|
104	What is the child's parental relationship with the TB case? 1=parent; 0=non parent	|__|__|
105	Do you incur costs when seeking care for your child? 0=No; 1=Yes	|__|
D. Clinical factors		
101	Is the child exhibiting symptoms of TB? 0=No; 1=Yes	|__|
102	What is the HIV status of the TB case? 0=Negative; 1=Positive	|__|
103	Previous history of TB treatment received by TB case? 1=first time 2=retreatment	|__|
104	What is the number of acid fast bacilli (AFB) seen on sputum microscopy (+)?	|__|
105	Was the child screened for TB? 0=No; 1=Yes	|__|
106	Does the child have a history of previous use of Isoniazid Preventive Treatment? 0=No; 1=Yes	|__|
2 SECTION 2: Health facility related factors		
201	Have you always been treated nicely by the health workers during your routine visits (TB treatment provider/TB case relationship)?	|__|
202	Was the child contact traced to their home? 0=No; 1=Yes	|__|
203	Was the child contact screened for evidence of active TB? 0=No; 1=Yes	|__|
204	Does the TB health facility offer (free) TB screening services such as sputum smearing, tuberculin skin test, chest x-ray and gene Xpert? 0=No; 1=Yes	|__|
205	Type of health facility? 1=public 2=private/faith based	|__|
206	Have you ever heard (been told) about the benefits of IPT? 0=No; 1=Yes	
3 SECTION 3: Community factors		
301	Were (are) you afraid your child could also get infected with TB? 0=No; 1=Yes	|__|
302	Were (are) you worried about what people will say or think if they noticed you or your child was sick of TB? 0=No; 1=Yes	|__|

303	Received IPT-associated health education in the community? 0=No; 1=Yes	|__|
304	Reluctance to allow your child to take medication in the absence of symptoms? 0=No; 1=Yes	|__|
305	Lack of money for transport (is the treatment facility accessible)? 0=No; 1=Yes	|__|
4 SECTION 4 : Isoniazid Preventive therapy (IPT) factors		
401	Were (are) you worried about the pill size and prolonged daily use of the drug (pill burden)? 0=No; 1=Yes; 2=NA	|__|
402	Were (are) you worried about the side effects of the drugs (drug side effects)? 0=No; 1=Yes; 2=NA	|__|
403	Was Isoniazid Preventive therapy fully supplied to you each time you came for a refill (regular INH supply)? 0=No; 1=Yes; 2=NA	|__|
404	Was there a period you stop receiving treatment because it was out of stock (stock outs)? 0=No; 1=Yes; 2=NA	|__|
405	Did you ever stop giving the Isoniazid Preventive therapy to your child for more than 2 weeks (poor adherence)? 0=No; 1=Yes; 2=NA	|__|
5 SECTION 5 : Outcome of IPT		
501	Child contact receive Isoniazid Preventive therapy (IPT uptake)? 0=No; 1=Yes	|__|
502	Did your child interrupt IPT intake for 60 consecutive days or more at point in time (drop out/default)? 0=No; 1=Yes; 2=NA	|__|
503	Did the child contact finish the six months course of Isoniazid Preventive therapy (treatment completion)? 0=No; 1=Yes; 2=NA	|__|
504	Did you (TB case/care giver) refused to enrol their child contact IPT for IPT? 1=Yes; 0=No; 2=NA	|__|
505	Did your child develop active TB disease while on IPT (treatment failure)? 0=No; 1=Yes; 2=NA	
506	Was your child's IPT discontinued by a health care worker due to adverse effects or any other reason (treatment discontinuation)? 0=No; 1=Yes; 2=NA	

Appendix 2: Interview guide for health workers

Introduction

Greet the interviewee. Introduce yourself and ask the interviewee to do the same.

State the purpose of the interview and inform the interviewee that in order to capture all the data from the interview, session will be recorded

1. Can you please tell me your personal perspectives about the use of isoniazid preventive therapy (IPT) to prevent TB amongst child contacts exposed to adults with smear positive pulmonary tuberculosis (SPPTB)?
2. Do you think the use of IPT has been effective since its implementation? Probe: If yes why do you think so? If no why do you think so?
3. In other words, what are the facilitators and/or barriers of IPT uptake by child contacts of SPPTB?
4. Why do you think not all child contacts receive this prevention?
5. Can you please tell me ways to address the challenges of IPT since its implementation?
6. Can you please tell me other suggestions that you think might be helpful to address the use of IPT to prevent TB amongst child contacts exposed to adults with SPPTB?
7. If nothing more, thank the interviewee and adjourn.

Appendix 3: Participant Information Sheet (parent/caregivers)

Title of study: Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Douala, Cameroon.

Introduction: My name is Dr. Ayeah Mark Chia and I am a graduate student from the School of Public health, University of Ghana, Legon, Accra. I am undertaking a research study entitled: "Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Douala, Cameroon". In case you have any questions, please contact me for details. Telephone number: +2330204623281 (GHA) or +237676842710 (CMR) and e-mail address: ayeahmarkchiatoh@yahoo.com.

Background and purpose of research: Childhood Tuberculosis (TB) remains a major public health problem worldwide, especially in developing countries. Despite clear evidence that isoniazid preventive therapy (IPT) can reduce the risk of progression from TB infection to disease in TB contacts, uptake of IPT by national TB programs is low, and IPT delivery is a challenge in many resource-limited settings with high TB-burden. Furthermore, the IPT initiation and completion rates amongst child TB program implementation settings in Cameroon has not been reported and may be sub-optimal. The aim of this study is to determine the level of isoniazid preventive therapy uptake and its associated factors amongst child contacts of smear positive TB cases in selected health facilities in Douala, Cameroon.

Nature of research: The study seeks to know the level of isoniazid preventive therapy uptake and its associated factors amongst child contacts of smear positive TB cases in selected health facilities in Douala, Cameroon. The study involves interviews and we will use interview based questionnaires to collect data from eligible participants.

This informed consent is to ensure that you understand the purpose and your responsibilities in the research before you decide if you want to be part or not. Before agreeing to participate, it is important that you understand the following explanation of the study.

What is involved: Information from your child's medical records will be used in this this study and you will be asked some questions about the child who may have been exposed to a patient with tuberculosis.

Duration: This interview would take from 30 to 45 minutes using a questionnaire.

Possible risks: There are no foreseen direct risks involved in your participation in this study except for your time and the need to provide some personal information which may be a form of inconvenience to you. However, this study is expected to explore the factors associated with the uptake of isoniazid preventive therapy amongst child contacts under 5 years who are exposed to tuberculosis.

Possible benefits: There are no direct benefits but the information you will provide will help to scale up the uptake of isoniazid preventive therapy and in turn reduce the burden of childhood tuberculosis.

Cost: There is no foreseen cost that is anticipated in the study.

Compensation: There is no payment involved in this study but you will be compensated with transport money if the interview is done at the health facilities.

Confidentiality: The information that will be extracted from the treatment folders is totally confidential and will not be disclosed to any unauthorized persons. It will only be used for research purposes. No information will be specifically connected to you, your child or family. The data collected will be transferred to a laptop and stored on a pen drive with no other document.

Voluntary participation/withdrawal: Participation is voluntary and you are free to withdraw from the study at any time without being penalized in any way. Withdrawal from the study does not prevent you from receiving any health services in the health facility.

Outcome and feedback: The outcome of the study will be disseminated through conferences to inform policy and feedback will be provided through articles at the health facilities and health directorate. Data will be shared to the national TB control programs through meetings at the various program offices.

Appropriate alternatives: Ideally we will use the interview based questionnaires but alternatively interview techniques may be employed where necessary such as self-administered survey.

Feedback to participant: Data will be shared to the facility through meetings with the chief medical officer (CMO), the district medical officer (DMO) and the administrators of the facility.

Funding information: This research is solely funded by sponsors; WHO/TDR.

Sharing of participants Information: The data will be solely owned by the PI of this study and the Co-PI also has access to the data however data will not be shared with no third party.

Provision of information and consent for participants: A copy of the signed participant information sheet and consent/assent form will be given to you before data collection commences.

Conflict of interest: The data is solely owned by the PI of this study and the Co-PI also has access to the data however data will not be shared with no third party.

For further questions, you may contact me: Dr. Ayeah Mark Chia, School of Public Health, University of Ghana, Legon. Tel: (+233) 0204623281 and email: ayeahmarkchiatoh@yahoo.com or contact my supervisor via email: fanto@ug.edu.gh. If you have any question about your rights as a study participant, you can contact the secretary of the Ethical Review Committee of the University of Douala at the following addresses:

Yvette Etuka
CEI-UDo secretary
Office: (237) 680359835/695393550
Mobile: (237) 675189836. Email: cei@univ-douala.com

Appendix 4: Participants information sheet (health worker)

Title of study: Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Douala, Cameroon.

Introduction: My name is Dr. Ayeah Mark Chia and I am a graduate student from the School of Public health, University of Ghana, Legon, Accra. I am undertaking a research study entitled: "Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Douala, Cameroon". In case you have any questions, please contact me for details. Telephone number: +2330204623281 (GHA) or +237676842710 (CMR) and e-mail address: ayeahmarkchiatoh@yahoo.com.

Background and purpose of research: Childhood Tuberculosis (TB) remains a major public health problem worldwide, especially in developing countries. Despite clear evidence that isoniazid preventive therapy (IPT) can reduce the risk of progression from TB infection to disease in TB contacts, uptake of IPT by national TB programs is low, and IPT delivery is a challenge in many resource-limited settings with high TB-burden. Furthermore, the IPT initiation and completion rates amongst child TB program implementation settings in Cameroon has not been reported and may be sub-optimal. The aim of this study is to determine the level of isoniazid preventive therapy uptake and its associated factors amongst child contacts of smear positive TB cases in selected health facilities in Douala, Cameroon.

Nature of research: The study seeks to know the level of isoniazid preventive therapy uptake and its associated factors amongst child contacts of smear positive TB cases in selected health facilities in Douala, Cameroon. The study involves interviews with health workers which will be audio recorded.

This informed consent is to ensure that you understand the purpose and your responsibilities in the research before you decide if you want to be part or not. Before agreeing to participate, it is important that you understand the following explanation of the study.

What is involved: Information on your personal perspectives about the use of IPT to prevent TB and barriers and/or facilitators of IPT uptake amongst child contacts exposed to adults with SPPTB will be asked.

Duration: This interview would take from 30 to 45 minutes.

Possible risks: There are no foreseen direct risks involved in your participation in this study except for your time and the need to provide some personal information which may be a form of inconvenience to you. However, this study is expected to explore the factors associated with the uptake of isoniazid preventive therapy amongst child contacts under 5 years who are exposed to tuberculosis.

Possible benefits: There are no direct benefits but the information you will provide will help to scale up the uptake of isoniazid preventive therapy and in turn reduce the burden of childhood tuberculosis.

Cost: There is no foreseen cost that is anticipated in the study.

Compensation: There is no payment involved in this study but you will be compensated with some food and water at the end of the interview.

Confidentiality: The information that you will provide is totally confidential and will not be disclosed to any unauthorized persons. It will only be used for research purposes. No information will be specifically connected to you or your health facility. The data collected will be transferred to a laptop and stored on a pen drive with no other document.

Voluntary participation/withdrawal: Participation is voluntary and you are free to withdraw from the study at any time without being penalized in any way. Withdrawal from the study does not have any consequences.

Outcome and feedback: The outcome of the study will be disseminated through conferences to inform policy and feedback will be provided through articles at the health facilities and health directorate. Data will be shared to the national TB control programs through meetings at the various program offices.

Appropriate alternatives: Ideally we will use the interview based questionnaires but alternatively interview techniques may be employed where necessary such as self-administered survey.

Feedback to participant: Data will be shared to the facility through meetings with the chief medical officer (CMO), the district medical officer (DMO) and the administrators of the facility.

Funding information: This research is solely funded by sponsors; WHO/TDR.

Sharing of participants Information: The data will be solely owned by the PI of this study and the Co-PI also has access to the data however data will not be shared with no third party.

Provision of information and consent for participants: A copy of the signed participant information sheet and consent/assent form will be given to you before the interview commences.

Conflict of interest: The data is solely owned by the PI of this study and the Co-PI also has access to the data however data will not be shared with no third party.

For further questions, you may contact me: Dr. Ayeah Mark Chia, School of Public Health, University of Ghana, Legon. Tel: (+233) 0204623281 and email: ayeahmarkchiatoh@yahoo.com or contact my supervisor via email: fanto@ug.edu.gh. If you have any question about your rights as a study participant, you can contact the secretary of Ethical Review Committee of the University of Douala at the following addresses:

Yvette Etuka
CEI-UDo secretary
Office: (237) 680359835/695393550
Mobile: (237) 675189836. Email: cei@univ-douala.com

Appendix 5: Consent Form (Parent/Guardian/Caregiver)

CONSENT FORM (Parent/Caregivers)

Title of study: Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Douala, Cameroon.

PARTICIPANTS' STATEMENT

I acknowledge that I have read or have had the purpose and content of the participant information sheet read and satisfactorily explained to me in a language English ☐ Pidgin English ☐ or French ☐. I understand and I fully understand the contents and any potential implications as well as the right to withdraw even after I have signed this form. I voluntarily agree to be part of this study.

Do I have your permission to record your interview? Yes ☐ No ☐

Participant initials or participant code: ……..

Participants' Signature: ……. …or thumb print

Date: ……..

INTERPRETATOR'S STATEMENT

I interpreted the purpose and contents of the Participant's information Sheet to the participant to the best of my ability in the language English ☐ Pidgin ☐ French ☐ to his/her proper understanding.

All questions, appropriate clarifications sort by the participant and answers that were also provided were duly interpreted to his/her satisfaction.

Name: …… Date: ……

Signature: …….

WITNESS STATEMENT.

I was present when the purpose and content of the participant information sheet was read and explained satisfactorily to the participants in the language English ☐ Pidgin ☐ French ☐ his/she understood.

I confirm that the participant was given opportunity to ask questions/seek clarification and same were duly answered to his/her satisfaction before voluntarily agreeing to be part of the research.

Name: …… Date: …….

Signature: ……

INVESTIGATORS STATEMENT

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's name ……..……

Signature: …… Date: ……...

Name: ……..……

Appendix 6: Consent form (health worker)
Principal Investigator: Ayeah Mark Chia

Organization: University of Ghana, Legon, Ghana

Sponsor: Tropical Diseases Research/World Health Organization

Title of Project: Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Douala, Cameroon

Certificate of Consent
The foregoing information has been read to me, or I have read it myself. I have had an opportunity to ask questions and all have been answered to my satisfaction.

I consent voluntarily to be a participant in the study

Name of Participant ……..

Signature ……

Date _____

Statement by the researcher

I have provided accurate information about the research to the potential participant and to the best of my knowledge made sure he/she understands that I would like him/her to participate. The participant was given an opportunity to ask questions which were answered to the best of my ability. The individual has given consent freely and voluntarily without coercion. A copy of this form has been provided to the participant.

Name of interviewer ……

Signature ……

Date _____

Appendix 7: Ethical Clearance from the Ghana Health Service Review Committee

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com
8th April, 2019

MyRef. GHS/RDD/ERC/Admin/App 19/105
Your Ref. No.

Mark Chia Ayeah
University of Ghana
School of Public Health
Legon

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC 037/03/19**
Project Title	Isoniazid Preventive Therapy Uptake amongst Child Contacts of Adults Diagnosed with Smear Positive Pulmonary Tuberculosis in Selected Health Facilities in Doula, Cameroon.
Approval Date	8th April, 2019
Expiry Date	7th Aril, 2020
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

Appendix 8: Ethical Clearance from the Institutional Ethics Committee for Research on Human Health, University of Douala

REPUBLIQUE DU CAMEROUN
Paix - Travail- Patrie
•
UNIVERSITE DE DOUALA

REPUBLIC OF CAMEROON
Peace - Work- Fatherland
•
UNIVERSITY OF DOUALA

CEI - UD

INSTITUTIONAL ETHICS COMMITTEE FOR RESEARCH ON HUMAN HEALTH

N° 1795 IEC-UDo/ 06/2019/T

Douala, the 06th of June 2019

ETHICAL CLEARANCE

The Institutional Ethics Committee for Research on Human Health of the University of Douala **(IEC-UDo)** for the 06th of June 2019 evaluation session, has examined the research project entitled **«Isoniazide preventive therapy uptake amongst child contacts of adults diagnosed with smear positive pulmonary tuberculosis in selected Health Facilities in Douala, Cameroon»** submitted by **AYEAH Mark CHIA** for Thesis At School of Public Health of the University of Ghana.

The present research project has a clear scientific interest and presents no risk for its participants. The objectives and methodology of this research project are clearly described. The principle of data confidentiality is respected. The required expertise for the supervision of the research is present.

From the above mentioned observations, the IEC-UDo approves this version of the project for a period of one year.

However, **AYEAH Mark CHIA** is responsible of the scrupulous respect of the methodology and ethical consideration, and should not amend it without approval of the IEC-UDo. Researchers are expected to collaborate with the IEC-UDo for a follow-up of the ethical aspects of the approved project. A copy of the final report of this research project should be submitted to IEC-UDo for archival purposes.

The present ethical clearance is delivered to serve the purpose for which it is presented. It can be cancelled in case of non-respect of the above recommendations.

Copy

- MINPH

CEI-UD Le Président

The PRESIDENT

Pr Léopold Gustave LEHMAN

NB : Only one copy of an ethical clearance is delivered.

N° 0977/Minsante/SESP/SG/DROS of April 16, 2012
Campus de Logbessou, 3è étage du bloc pédagogique de la FMSP.
Tél. : (237) 680.35.98.35 / 695.39.35.50 / B.P. : 2701 Douala - Cameroun / e-mail : cei@univ-douala.com

Appendix 9: Ethical Clearance from the Cameroon Baptist Convention Health Services Institutional Review Board

CAMEROON BAPTIST CONVENTION HEALTH SERVICES
INSTITUTIONAL REVIEW BOARD

Baptist Centre, Nkwen, P.O. Box 1, Bamenda, Northwest Region

June 27, 2019

Ayeah Mark Chia .MD,
University of Ghana
School of Public Health
ayeahmarkchiatoh@yahoo.com

IRB study number: IRB2019-24
Title of Protocol: **Isoniazid preventive therapy uptake amongst child contacts of adults diagnosed with smear positive pulmonary tuberculosis in selected health facilities in Douala, Cameroon.**

IRB approval date: June 27, 2019
IRB expiration date June 27, 2020

Dear Mark,

Your proposed research seeks to assess the level of IPT uptake and determine its associated factors amongst child contacts of adults diagnosed with smear positive pulmonary tuberculosis (SPPTB)

Your study protocol was reviewed by members of the CBC Health Board IRB and has been granted expedited approval this 27th June, 2019. Your protocol will be presented at our next Board meeting to the entire Board for final approval and an email will be sent to you regarding the Board's decision.

Please understand that this is the ethical and safety approval for your study. You must present this IRB approval letter and the email stating the contingencies have been met to the Hospital Administrator and Chief Medical Officer for approval to do the study in that institution.

Please work strictly as per the protocol presented to the IRB.

If you make any changes in the research protocol, please immediately send the IRB an amendment specifying the changes proposed.

The Board grants approval for this study for a one-year time period. Thereafter, before June 27, 2020, you will please complete our renewal form/final report which will be attached to an email and return it to me. The completed form must be reviewed and approved by the Institutional Review Board prior to the expiration date of the current approval period. The fee to renew a study protocol is 10,000 cfa.

Your protocol has been assigned the above reference IRB protocol number. All correspondence to us should include:

1. The IRB protocol number
2. Name of the principal investigator and,
3. full title of the study.

Finally, all abstracts, manuscripts, posters and presentations pertaining to the above protocol, must be submitted to the IRB for pre-publication approval.

Please feel free to contact me with any questions and/or concerns regarding the above. Copies of all correspondence regarding this proposal should be sent to me and to Zita Acha secretary, e-mail CBCHBIRB@gmail.com.

Sincerely,

Mr. Samuel Ngum

CAMEROON BAP 1ST CONVENTION INSTITUTIONAL REVIEW BOARD HEALTH SERVICES

Mr. NGUM Samuel, Chairperson, Chaircbcirb@gmail.com
Mrs. Acha Zita, Secretary, cbchbirb@gmail.com